Department of Agriculture and Commerce,
N.-W. Provinces and Oudh.

FIELD AND GARDEN CROPS

OF THE

NORTH-WESTERN PROVINCES AND OUDH,

WITH ILLUSTRATIONS.

PART II.

BY

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PANICUM MILIACEUM, LINN.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.
Thos. D. Boas, Supdt.

FIELD AND GARDEN CROPS

OF THE

NORTH-WEST PROVINCES AND OUDH.

PART II.

PANICUM MILIACEUM, *Linn.**

[*Vide* Plate XXIII.]

ENGLISH, none ; VERNACULAR, **chehna, chinwa, chirwa, sáwan-chaitwa,** and **sáwan-jethwa** (Barabanki), **kuri** (Mainpuri), **phikar, rali, bansi** (all three in Bundelkhand); the **varagu** of Southern India ; Sanscrit, **anu, vrihibheda.**†

Description.

Natural order *Gramineæ*, tribe *Paniceæ*. An annual herbaceous grass with fibrous roots. Stems many, 2-4 ft. high, branching, striate, often rough with long bulbous-based hairs. Leaves large ; sheaths 4-5 in. ; ligule shallow, ending in a fringe of silky hairs ; blade 12-16 in. long and about ½ in. across, acuminate, upper surface clothed with long silky hairs. Spikelets 2-flowered, arranged in gracefully drooping smooth panicles ; glumes unequal, cuspidate, the lower one small, ovate, with five prominent nerves ; pales of the sterile flowers 2, membranous, the lower one mucronate and resembling the outer glume, the inner one smaller, emarginate or bifid ; pales of the hermaphrodite flower about equal, concave, cartilaginous. Lodicules 2, triangular, fleshy, equalling the ovary. Fruit (the grain) enclosed by the pales, small, oval, yellowish brown, polished.

Origin.

Decandolle in his recent work on the " Origin of Cultivated Plants " is inclined to consider this plant to have been originally a native of Egypt or Arabia. Its introduction into India, however, must have taken place at a very early period, considering the fact of its having received Sanscrit names.

Chehna is one of six small millets which figure in the agriculture of the Provinces ; and judged by the area of its cultivation, it is of but little economic importance. It is nearly related to *sawan*, the millet next noticed, and in some districts is considered a kind of sawan, a circumstance which has led to some confusion in nomenclature. Thus, in Barabanki, the name for chehna is *sawan-chaitwa* or *sawan-jethwa*, which denote respectively the sawan sown in April and reaped in May. This indicates the leading characteristic of chehna from an agricultural point of view, which is that it is almost exclusively a hot weather crop, whereas the other millets are grown during the monsoon. It requires of course copious irrigation, and the patches of chehna clustering round the

* **References** :—Linn. Sp. Pl. 86 ; Roxb. Fl. Ind. i. 310 ; Parlatore Fl. Ital. i. 122 ; Baden-Powell Punj. Prod. p. 237 ; Gaz. N.-W. P., Vol. x. 688 ; DC. L'Orig. Pl. Cult. p. 302.

† Piddington Index 66.

wells in some tracts afford considerable diversity to the monotonous waste of a hot weather landscape.

Varieties. In Bundelkhand chehna bears the names of *phikar* and *rali*, and is grown as a rain and not as a hot weather crop. The two names indicate separate varieties, one of which (phikar) is sown and reaped rather earlier than the other (rali), and yields a rather heavier outturn.

Distribution. The tract in which chehna cultivation is commonest is that comprising the districts of Aligarh, Etah, Mainpuri, and it is noticeable that this is a locality especially characterized by the extent of its well irrigation. It is well known that chehna prefers well to canal water. No accurate statistics are available of the area under chehna, but from some data which have been collected, it would appear that in the Meerut Division it covers 4,500 acres, in the Agra Division 5,000 acres, in the temporarily settled districts of the Allahabad and Benares Divisions 1,500 and 1,400 acres, respectively, while its cultivation is wholly insignificant in Rohilkhand on one side and Bundelkhand on the other.

Seasons. It is sown in March after an irrigation at the rate of about 10 lbs. to the acre. It ripens towards the middle of May, by which time it will often have required as many as 14 waterings. The crop is a precarious one, and is very liable to damage from the hot winds, which rush over the country during this season, and which may altogether level with the ground a freshly irrigated crop, and scatter the grain from the ear if it is fully ripe. Hence the proverb—

"Chena ji ka lena, chaudah páni dena,
Vya chale, to na lena na dena."

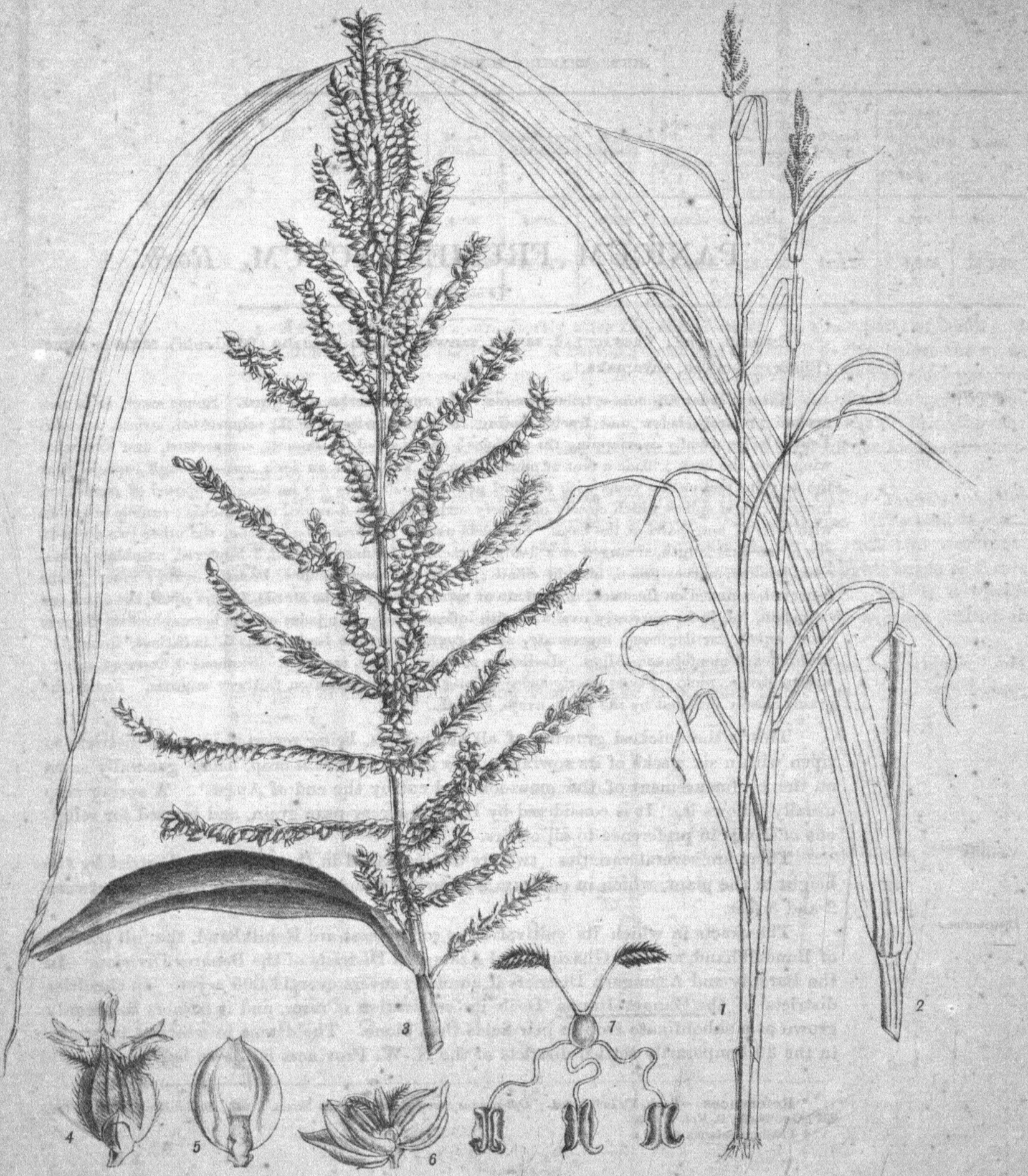
In the Lucknow District chehna is reported to be very commonly sown on fields from which a crop of peas has been just harvested. This indicates an appreciation of the use of leguminous crops in rotation with cereals.

Average outturn. A fair average yield of grain would be from 6 to 8 maunds to the acre. The straw is of no use as fodder, and is thrown on the manure heap or used as bedding.

Explanation of Plate XXIII.

1. Entire plant, (reduced to one-fourth.)
2. Upper portion with inflorescence, (nat. size.)
3. } Single spikelet.
4. }
5. Flower with outer pale removed, } enlarged.
6. Ditto with both pales and the lodicules removed, }
7. Grain, }

Drawn from a living specimen gathered in Dehra Dún.



PANICUM FRUMENTACEUM, Roxb.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

PANICUM FRUMENTACEUM, *Roxb.**

[*Vide* Plate XXIV.]

ENGLISH, none ; VERNACULAR, **sáwan, sánwan, sáwan-bhadeha** (Barabanki), **sáma** or **samei** (Bijnor) ; Sanscrit, **shyámaka.**†

Description.

Natural order *Gramineæ*, tribe *Paniceæ*. An annual herbaceous grass. Stems erect, or in rich ground prostrate below and freely rooting from the nodes, 2-4 ft., compressed, striate, smooth. Leaves large, usually overtopping the panicles ; sheaths 5-6 in., smooth, compressed, and somewhat winged on the back ; blade a foot or more in length, and about an inch across, rough especially at the margins and on the veins with forward prickles. Panicles 6-8 in. long, composed of condensed incurved rigid spikes which closely or loosely surround the 5-6-angled main rachis ; panicle branches with tufts of long hairs at the base. Spikelets usually in threes, one sessile, the other two on pedicles of unequal length, arranged on a 3-angled rachis. Glumes unequal, 3-5-nerved, cuspidate pubescent, hyaline, nerves green, margin ciliate ; lower one much smaller, broadly ovate ; inner glume 5-nerved, rounded on the back, mucronate or awned ; pales of the sterile flowers equal, the outer one cuspidate, the inner narrowly oval and with inflexed margins ; pales of the hermaphrodite flowers about equal, cartilaginous, mucronate, outer rounded on the back, veins 5, indistinct, inner flat, with inflexed membranous edges. Lodicules 2, fleshy, entire, truncate. Stamens 3, exserted, erect ; anthers large, pink. Styles nearly twice as long as the two crimson feathery stigmas. Fruit (the grain) closely invested by the pales, ovate, smooth.

This is the quickest growing of all the millets, being reported in some districts to ripen within six weeks of its sowing. It is grown as a rain crop, being generally sown at the commencement of the monsoon, and cut by the end of August. A spring crop usually follows it. It is considered by Hindus a very pure grain, and is used for religious offerings in preference to all others.

Varieties.

There are several varieties ; two are distinguished in the Azamgarh District by the height of the plant, which in one case is between 3 and 4 feet, and in the other between 2 and 3 feet.

Distribution.

The tracts in which its cultivation is commonest are Rohilkhand, the hill portion of Bundelkhand, and the Ghazipur and Azamgarh Districts of the Benares Division. In the Bareilly and Azamgarh Districts it annually covers over 11,000 acres. In the drier districts of the Ganges-Jumna Doáb its cultivation is rarer, and it is more commonly grown as a subordinate crop in juár fields than alone. The extent to which it is grown in the 30 temporarily settled districts of the N.-W. Provinces is shown below :—

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* References :—Roxb. Fl. Ind. i. 304. ; *Oplismenus frumentaceus*, Kunth Enum. i. 146 ; Baden-Powell Punj. Prod. 237 ; Gaz. N.-W. P. Vol. x. 689.

† Piddington Index 66.

Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur.	Benares Division, including Azamgarh, Basti and Gorakhpur Districts only.	Jhansi District.	Kumaun Division, including Tarai District only.	Total.
acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
9,972	25,072	521	10,815	14,933	10,386	4,281	75,980

Season. As a rule sawan is sown shortly after the rains break. In some parts of Oudh and the Benares Division, however, it is customary to sow it a week or two before the monsoon sets in if there is a fall of rain in the hot weather, and it becomes therefore possible to plough up the ground. The seed does not germinate until the rain falls upon it, but the plants get a start if sown in this manner, which has the advantage of bringing the grain sooner to maturity, and enabling the ground to be cleared sooner for the preparation for the succeeding spring crop.

Soil. The soil should be rather light than heavy, and it is said that in Azamgarh land with some admixture of *usar* salts is rather preferred than otherwise.

Sowing. The seed is sown at the rate of 10 lbs. to the acre, and the young plants require at least two weedings.

Diseases and injuries. The crop is liable to damage from excessive rain, and suffers from blight, but is as a rule a generous one, producing from 8 to 10 maunds of grain to the acre.

Outturn. This is, however, only on fairly good soil, and on the poor land of Bundelkhand the average outturn is said not to exceed 4 maunds to the acre.

Sawan has a special utility to the poorer classes in its early ripening, which affords a supply of cheap grain during August and September before the bájra harvest commences.

Explanation of Plate XXIV.

1. Entire plant (reduced).
2. A lower leaf, } nat. size.
3. Inflorescence, }
4. } A spikelet, enlarged.
5. }
6. }
7. A flower with pales and lodicules removed, enlarged.

Drawn from a living specimen gathered in Dehra Dún.

1

2

SETARIA ITALICA, BEAUV.

Drawn by H. Hormuzji.

Litho T. C. Press, Roorkee.
Thos D. Bona, *Supdt.*

SETARIA ITALICA, *Beauv.*[*]

[*Vide* Plate XXV.]

ENGLISH, Italian millet; VERNACULAR, kákun, kángni, kauni, tángan (Azamgarh), kákni (Bijnor); Sanscrit, kángu, priyangu.[†]

Description.

Natural order *Gramineæ*, tribe *Paniceæ*. A tall handsome grass with long nodding bristly flowering spikes. Stems many, erect, 3-5 ft. high, round, smooth, rooting from the lower nodes. Leaves 1½-2 ft. long and about 1 in. broad, rough with forward bristles; sheaths about 8 in. long, sulcate, striate, pilose not hispid; ligule bearded. Panicles ovate, closely arranged in a compact more or less cylindrical spike; rachis densely pilose. Spikelets 2-flowered, intermixed with sterile setiform peduncles disposed in the form of an involucre; upper flower hermaphrodite, lower sterile. Glumes very unequal, ovate, acute, membranous. Pales equal, smooth, rounded. Lodicules 2, obcuneate, truncate. Fruit (the grain) closely invested by the pales, light yellow, roundish, subcompressed, with a broad furrow on one side proceeding from the embryo.

Origin.

Decandolle mentions China, Japan and the Indian Archipelago as the countries from which this plant has most probably originated and spread. It was one of the five plants which the Chinese Emperor had to sow every year according to the order given by Chen-nung 2,700 before Christ. The Sanscrit name *kangu* indicates its antiquity as a cultivated plant in India.

Kakun is much esteemed as an article of human food in some districts, and is eaten both in the form of cakes and as porridge, but an objection commonly made to it is that it has heating properties. It is also grown as food for cage birds, and is popularly supposed to be of medicinal use in alleviating the pains of child-birth. The grain may be straw-yellow or reddish-yellow, and this indicates at least two varieties.

Area.

The area under kakun is even smaller than that under chehna. In each of the Meerut and Rohilkhand Divisions it amounts to about 1,200 acres. In the districts of the Agra Division it is somewhat larger (about 1,600 acres), and in the Allahabad Division it reaches the comparatively high figure of 8,000 acres. The area which it covers in the three districts of Azamgarh, Basti and Gorakhpur is about the same as that in Rohilkhand. In the Jhansi Division it is reported to be grown on 2,600 acres. But it is far more commonly grown as a subordinate crop than by itself, and these figures greatly under-estimate its real agricultural importance. In the Doáb it is commonly sown in juár or chari fields on better class land, and in the Azamgarh District it is very generally mixed with sawan.

Seasons.

It is sown with the commencement of the rains and reaped in September, being as

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[*] **References**:—Beauv. Agrost. 51; Kunth Enum. i. 153; Parlatore Fl. Ital. i. 113; Gaz. N.-W. P. Vol. x. 689. *Panicum italicum*, Linn.; Roxb. Fl. Ind. i. 302; Drury Useful Pl. of India 326; DC. L'Orig. Pl. Cult. 303. *Pennisetum italicum*, R. Br.; Baden-Powell Punj. Prod. 237.

[†] Piddington Index 66.

Soil and Manuring.

Outturn.

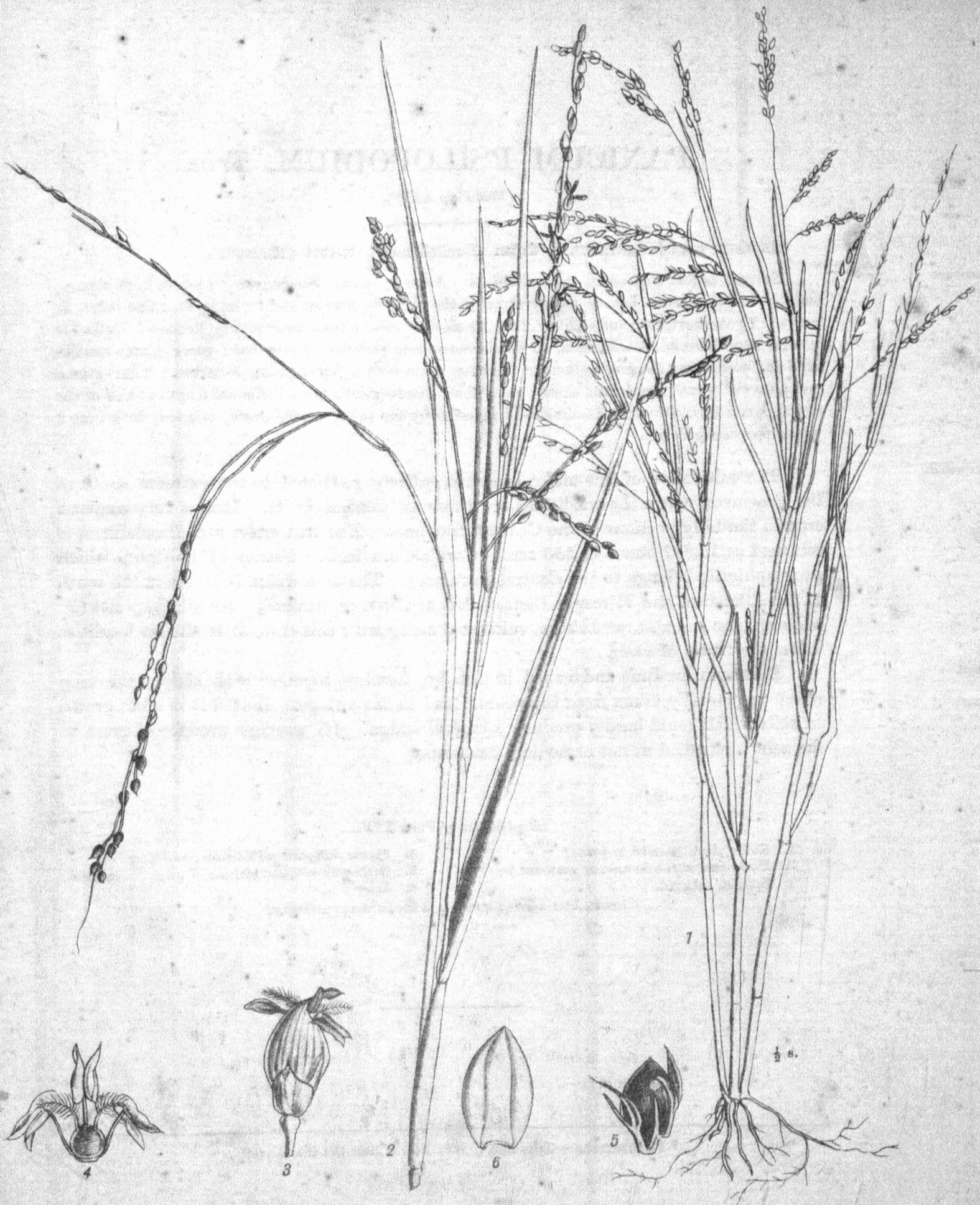
Injuries.

a rule grown on the good land of the village, and often on the highly manured fields round the village site. As a general rule it is followed by a spring crop. Its outturn is not so large as that of sawan, averaging, when grown close, from $3\frac{1}{2}$ to 5 maunds per acre. Great loss is suffered by the depredations of birds, who are particularly fond of the grain, and there is a common saying, "Kakun kheti, baj dharna," *i.e.*, (the cultivation of kakun is like keeping a hawk). The straw is no more nutritious as cattle-fodder than rice straw, and is not therefore set much store by.

Explanation of Plate XXV.

1. Cluster of spikelets.
2. Upper part of plant with inflorescence, (reduced to $\frac{1}{3}$ nat. size.)

Drawn from a living specimen gathered near Mussoorie.



PANICUM PSILOPODIUM, Trin.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.
Thos. D Bona, Supdt.

PANICUM PSILOPODIUM, *Trin.**

[*Vide* Plate XXVI].

ENGLISH, none; VERNACULAR, **kutki** (Bundelkhand), **mijhri** (Mirzapur).

Description.

Natural order *Gramineæ*, tribe *Paniceæ*. Annual, erect. Stems many, 1½-2 ft. high, striate, smooth and polished. Leaves falling short of the panicles, narrow and tapering to a fine point, 5-nerved; ligule short, torn and ciliate. Panicles slender, erect; branches capillary, flexuose. Spikelets smaller than those of *P. miliaceum*, on slender ascending pedicles, 2-flowered; outer glume smaller than and embracing the inner glume at the base, ovate with a blunt point, 3-nerved; inner glume many-nerved, ovate, lanceolate, acute; pales of the lower (sterile floret) of equal length; pales of the fertile florets cartilaginous. Grain closely invested by the pales, small, ovate, pointed, dark brown when ripe, and polished.

Distribution.

The cultivation of this millet is almost entirely restricted to the extreme south of the Provinces, where the conditions are those of Central India. It is a very common crop in the hilly portions of the Central Provinces. The area under it in Bundelkand is returned as 16,847 acres, 11,553 acres of which are in the district of Lalitpur, which geographically belongs to the Central Provinces. The area which it covers in the south of the Allahabad and Mirzapur Districts has not been ascertained. An allied species (*P. miliare*, Linn.) is also, we believe, cultivated along with this crop, or in similar localities under the name of *kutki*.

Area.

Season.

It is sown in June and reaped in October, forming, together with kodon, the crop which is generally taken from the poorest land in the village. Indeed it is often grown on soils which could hardly produce a crop of kodon. Its average produce of grain to the acre is returned as not exceeding 2 maunds.

Outturn.

Explanation of Plate XXVI.

1. Entire plant, (reduced to ½ size.)
2. Upper part with inflorescence, (nat. size.)
3. Spikelet, enlarged.
4. Flower with pales and lodicules removed,
5. Grain with withered remains of pales,
6. Inner pale,

} enlarged.

Drawn from a living specimen in the Saháranpur Garden.

* **References**:—Trin. Diss. ii. 217; Nees in Mart. Fl. Braz. ii. 199.

PASPALUM SCROBICULATUM, *Linn.**

[*Vide* Plate XXVII].

ENGLISH, none; VERNACULAR, **kodon, koda, kodrám** (Bijnor); Sanscrit, **koradusha, kodrava.**†

Description.

Natural order *Gramineæ*, tribe *Paniceæ*. A smooth annual herbaceous grass. Stems many, branching, about 2 ft. high, compressed. Leaves overtopping the flower spikes; sheaths long, the upper ones spathelike and often embracing the spikes; blade narrow, tapering gradually to a fine point. Spikes 2-4, terminal and axillary, sessile; spikelets in two rows on one side of a broad membranous flattened flexuose rachis, 1-flowered, sessile. Glumes equal, membranous, lower 3-nerved, inner one 5-nerved. Pales about equal, cartilaginous, outer one hard and brittle, inner thinner with membranous auricle-like projecting edges embracing the stamens and pistil. Lodicules 2, obcuneate, truncate. Stigmas projecting from between the pales, orange brown. Fruit (the grain) enclosed by and adherent to the pales, brown, smooth, roundish, about the size of hemp seed.

Distribution.

Kodon is a native of India; it is grown far more extensively than any of the other minor millets, and over a large portion of the Provinces is the favourite crop for inferior outlying land. This is, however, on account of the readiness with which it grows on the poorest soil, and not by reason of the quality of its grain, which is by no means a popular article of food. Indeed there is a saying current in some parts of the Provinces that hell is the destination of any one who dies within 21 days after eating it. It is not used for religious offerings.

Area.

The area under kodon in the 30 temporarily settled districts of the N.-W. Provinces is shown below:—

Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur District.	Benares Division, including Azamgarh, Basti and Gorakhpur Districts only.	Jhansi Division.	Kumaun Division, including Tarai District only.	Total.
acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
25	35,804	684	96,789	19247	60,175	not returned.	2,12,724

The districts in which the area is largest are those lying south of the Jumna. Banda returns 24,446 acres, Hamirpur 24,934 acres, Lalitpur 47,051 acres, and the trans-Jumna portion of the Allahabad District 47,139 acres. The wealth of a tract might be almost assumed to stand in inverse ratio to its area of kodon cultivation. Kodon is grown merely as a means of subsistence, and without much expectation of rent or profit.

* **References**:—Roxb. Fl. Ind. i. 278; Baden-Powell Punj. Prod. p 238; Gaz. N.-W. P. Vol. x. p. 688.

† Roxburgh (l. c.) Piddington Index 66.

Season. It is as a rule sown at the commencement of the rains, at the rate of from 12 to 20 lbs. to the acre, and is cut in October. In Oudh it is reported to be occasionally sown on dry soil before the monsoon commences, and to germinate when the rains break. In the districts where its cultivation is most extensive it is generally grown alone; in the Doáb it is often mixed with cotton, and in the Benares Division with arhar. It is never succeeded by a spring crop, since it as a rule ripens too late to be off the ground in time. The soil on which it is grown is also generally too poor to bear two crops within the year, and kodon is said to be an exhausting crop.

Mixtures.

Soil.

Weeding. Careful weeding is needed to secure a good outturn, which is estimated at from 10 to 12 maunds of grain to the acre, but a large proportion of this weight consists of chaff, for the husk of kodon is especially thick and heavy. The grain is separated with great difficulty. The plants are allowed to lie for a week or so after being reaped, in order to loosen the grain, which is even then not thrashed out without a good deal of trouble. The grain is husked by being ground in earthen mills (Allahabad).

Outturn.

Harvesting

Injuries. Kodon suffers considerably from the attacks of insects, but is said to be protected from the ravages of birds by the fact that its ear is partially concealed in the leaf sheath, as is the case with the coarse varieties of rice.

A curious fact connected with the grain is its liability to produce a sort of intoxication, which is vouched for by many authorities. The Settlement Officer of Azamgarh writes that instances of intoxication caused by kodon imported from the trans-Gogra Districts (Basti and Gorakhpur) are known to the people, but that no such effect have been noticed from grain locally produced. The reason for the intoxicating effect of Kodon grain under certain circumstances may perhaps lie in the fermentation which is undoubtedly brought about in order to loosen the husk and make it more easily removeable.

Explanation of Plate XXVII.

1. Spike, outer side. | 2. Ditto, inner side, showing the flattened rachis.

Drawn from a living specimen gathered at Saháranpur.

ELEUSINE CORACANA, *Gærtn.**

[*Vide* Plate XXVIII].

ENGLISH, none; VERNACULAR, **mandua, marua, makra** and **rotka** (Jalaun). The **ragi** of Southern India; Sanscrit, **rajika.**†

Description.

Natural order *Gramineæ*, tribe *Chlorideæ*. A medium-sized annual grass. Stems several, erect, 2-4 ft. high, somewhat compressed, smooth, sulcate. Leaves with long finely sulcate sheaths; ligule shallow, densely bearded; blade 1-2 ft., linear, smooth, striate. Spikes 4-6, digitate, incurved, with usually one or more isolated ones placed lower down and representing a second verticil; spikelets sessile, 2-5 in., arranged in two rows on one side of a flattened somewhat flexuose and minutely toothed rachis. Florets sessile, distichous. Glumes lanceolate, boat-shaped, with membranous margins, keel prominent, edged with minute forward prickles; outer one about twice as long as the inner; lower pale ovate mucronate, the middle nerve forming a prominent keel; inner pale smaller, bifid, the two principal nerves keeled and armed with small prickles. Lodicules very small, entire or bilobed at the apex. Ovary smooth, shortly stalked; styles 2, with long feathery stigmas. Seed globular and about the size of mustard, dark reddish brown, transversely wrinkled, enclosed in a loose membranous pericarp.‡ Var. *stricta* (*E. stricta*, Roxb. l. c. 343), stems 2-5 ft. high, spikes straight.

Origin.

Mandua is a native of India. Its specific name is founded on the Cinghalese word *kourakhan*. There is an allied species (*Eleusine ægyptiaca*) bearing the same vernacular name (*makra*), and occurring commonly throughout Upper India, which presents to a superficial examination hardly any points of difference from the cultivated plant; the seed of this wild plant is collected by the poorer classes as an unpalateable, though often very serviceable, food. The grain of the cultivated mandua is anything but popular diet. Cakes made from it are very dry eating, and little satisfies an empty stomach. For this reason it is reckoned an economic grain by the poor. But no one eats mandua cakes by preference. It causes, people say, as much discomfort to the stomach as a woollen loin cloth to the skin, and hence the proverb

"Mandua ka roti kamala ka dhoti."§

Varieties.

In addition to the more important variety mentioned above, Roxburgh has described several sub-varieties of this latter, differing in the nature of the soil in which they are cultivated, and also in the season of harvesting, some of them ripening early enough to be succeeded by a crop in the following rabi.

Distribution.

It is cultivated under two very different circumstances in these Provinces. The most important position it fills is that of the chief food grain of the hill tracts on their northern border, where it is very extensively cultivated. In Jaunsár Báwar it forms the chief article of food of the hill men, and is grown on the very poorest soil, often yielding a crop from mere stones and shingle. It is on the other hand very rarely

* **References** :—Gærtn. Carp. i. 8; Roxb Fl. Ind. i. 342; Drury Useful Pl. of Ind. p. 193; Baden-Powell Punj. Prod. p. 238; Gaz. N.-W. P. Vol. x. p. 690; DC. L'Orig. Pl. Cult. 308; *Cynosurus Coracanus*, Linn.; *C. tristachys*, Lamk.

† Piddington Index 33.

‡ Roxburgh (l. c.) calls this an aril.

§ Azamgarh Settlement Report.

ELEUSINE COROCANA, GÆRTN.

Drawn by B. Hormuzji

Litho T. C. Press, Roorkee
Thos D. Bona. *Supdt.*

grown in the hilly country to the south of the Provinces, where its place is taken by kodon. But it is grown to a greater or less extent over the whole of the Provinces, and in the more fertile districts its cultivation is often attended with considerable care, and results in a very large weight of produce. The area under mandua in the 30 temporarily settled districts of the N.-W. Provinces is shown below. The figures are only approximately correct :—

Area.

Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur.	Benares Division, including Azamgarh, Gorakhpur, and Basti only.	Jhansi Division.	Kumaun Division, including Tarai District only.	Total.
acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
14,712	1,663	5,035	6,516	14,962	121	160	43,169

58 per cent. of the total area is contributed by the two districts of Dehra Dún (including Jaunsár Báwar) (11,365 acres), and Azamgarh (14,395 acres).

Soil.

Sowing.

Injuries.

Weeding.

Manuring.

Outturn.

It prefers light soils, and is sown at the commencement of the rains, at the rate of 10 lbs. of seed to the acre. In the Allahabad and Azamgarh Districts it is reported to be occasionally sown in seed beds and transplanted like rice. In this case the seed is sown with irrigation in May, and the seedlings are planted out when the rains break. It suffers greatly from heavy rain, and a good year for rice is a bad year for mandua, and *vice versâ*. It should be weeded two or three times, and when carefully cultivated often receives a top dressing of manure after the first weeding. The yield is the heaviest of any of the minor millets, since not only is the gross weight of the produce large, but only a small proportion of this weight consists of husk. In this respect mandua is the most profitable of the minor millets. With sawan and kodon for instance, the husk contributes almost 50 per cent. of the weight, while with mandua it only amounts to 4 or 5 per cent.

Where carefully cultivated 12 to 14 maunds of grain may be expected to the acre, but in the hills a much smaller produce than this is gathered, and cultivators would be content with 5 or 6 maunds.

Explanation of Plate XXVIII.

1. A leaf,
2. A head of digitate spikes, } nat. size.

3. Upper part of plant with immature inflorescence, } nat. size.

Drawn from a living specimen gathered at Saháranpur.

VIGNA CATIANG, *Endl.**

[*Vide* Plates XXIX. and XXX.]

ENGLISH, none ; VERNACULAR, **lobia, rawás, rausa, sonta.**

Description.

Natural order *Leguminosæ*, sub-order *Papilionaceæ*, tribe *Phaseoleæ*. A smooth climbing or sometimes sub-erect herb. Leaves trifoliolate ; stipules inserted above the base, ovate, acute at both ends ; petioles about as long as the leaflets, deeply channelled ; stipels roundish ; leaflets 3-6 in. long, rhomboid ovate, variable in breadth. Flowers in clusters at the summit of the peduncle ; peduncles axillary, usually exceeding the leaves, bearing at the summit a few (3-6) shortly pedicelled flowers. Calyx teeth lanceolate or deltoid, cuspidate. Corolla twice as long as the calyx ; standard pale blue or reddish purple inside, and yellowish at the back ; keel truncate, whitish. Stamens diadelphous. Style filiform, bearded on the inner face. Pod long, nearly straight, many-seeded, torulose. Seeds 10-20, white, brown or black.

Lobia has a strong superficial resemblance to *múng* and *úrd*,† but may be easily distinguished from them by the possession of reddish purple instead of yellow flowers, and by its foliage being glabrous or destitute of the hairs which thickly cover the stalks and leaves of the two other pulses. It is as a rule grown for its grain, and forms like úrd and múng a humble associate of the kharif millets. A variety with very long pods is cultivated by market gardeners as a vegetable. Its pods are picked while green, and take, but very unworthily, the place occupied by French beans in European cookery. The seeds like those of múng and úrd vary considerably in colour, the white kind being considered the best.

Varieties.

Area.

Mixtures.

Season.

Outturn.

It is less frequently grown as a sole crop than either múng or úrd, and the area which it occupies by itself is quite insignificant except in the Rohilkhand Division, where it amounts to about 5,000 acres. On the other hand it forms portions of the undergrowth in a large proportion of kharif millet and cotton fields, with which it is sown at the commencement of the rains. It ripens in October or November, and yields a produce of about the same quantity as that of úrd. Its grain is less valued than that of úrd or múng, being difficult of digestion, and apt, according to native ideas, to generate heat in the stomach. The leaves and stems are used as cattle fodder.

Explanation of Plate XXIX.

1. Cluster of ripe pods, (nat. size.)
2. Single pod with one valve partially removed and exposing the seeds, (nat. size.)
3. Flower with calyx and corolla removed, } enlarged.
4. „ with keel and one wing petal removed, } enlarged.
5. „ seen from behind, } enlarged.

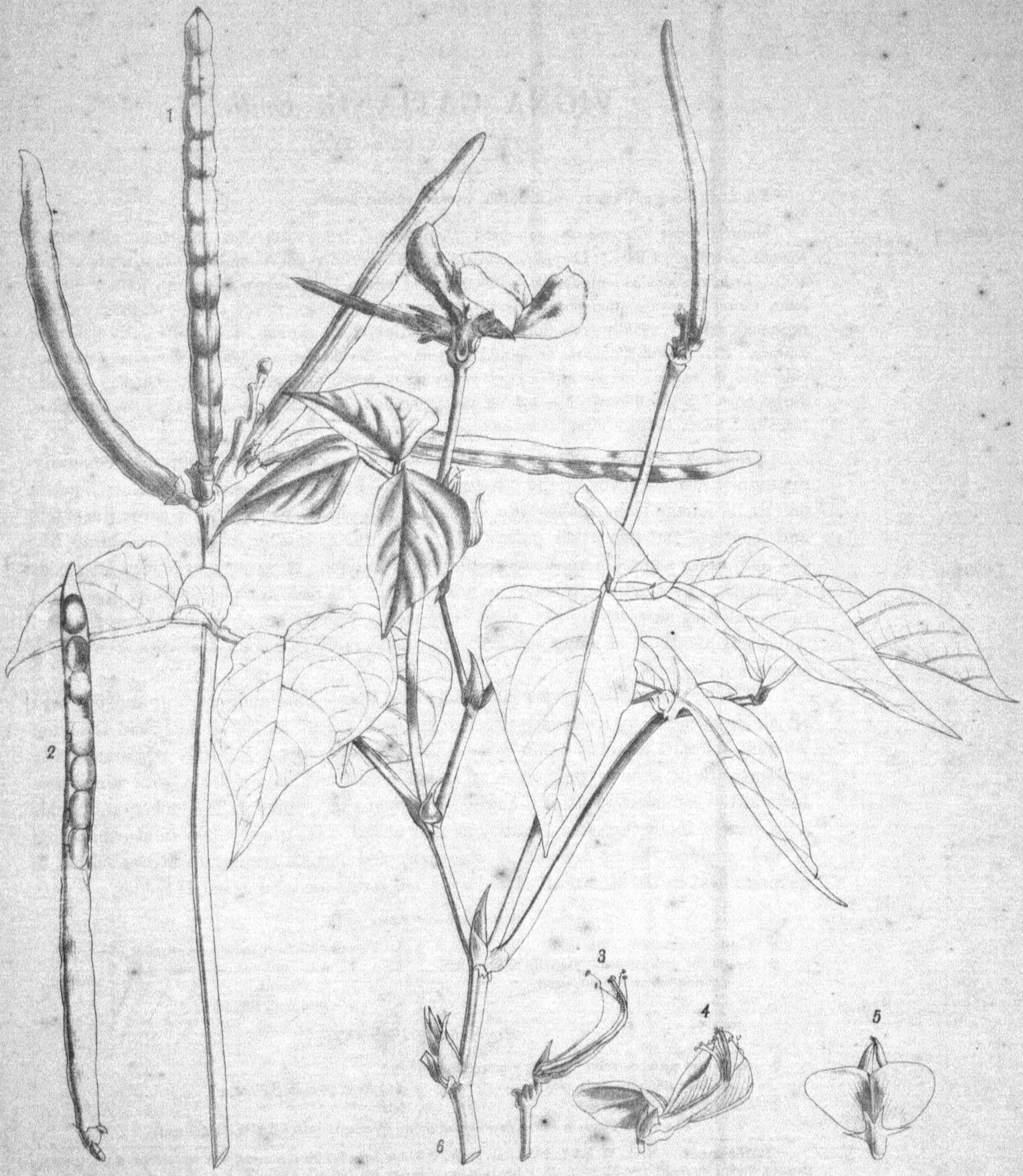
Explanation of Plate XXX.

1. Single pod with one valve partially removed and exposing the seeds, (nat. size.)
2. Cluster of pods, (nat. size.)
3. } As in preceding Plate.
4. } As in preceding Plate.
5. } As in preceding Plate.

The above Plates are from drawings of living specimens gathered near Saháranpur.

* **References** :—Hook. Fl. Ind. ii. 205 ; Gaz. N.-W. P. Vol. x. page 695 ; Ind. Forester Vol. ix. (1883) p. 203. *Dolichos Catiang*, Linn. ; Roxb. Fl. Ind iii. 303. *D. sinensis*, Linn. ; Roxb. Fl. Ind. iii. 302 ; W. & A. Prod. 250 ; Baden-Powell Punj. Prod. 241 ; Drury Useful Pl. of Ind. 186.

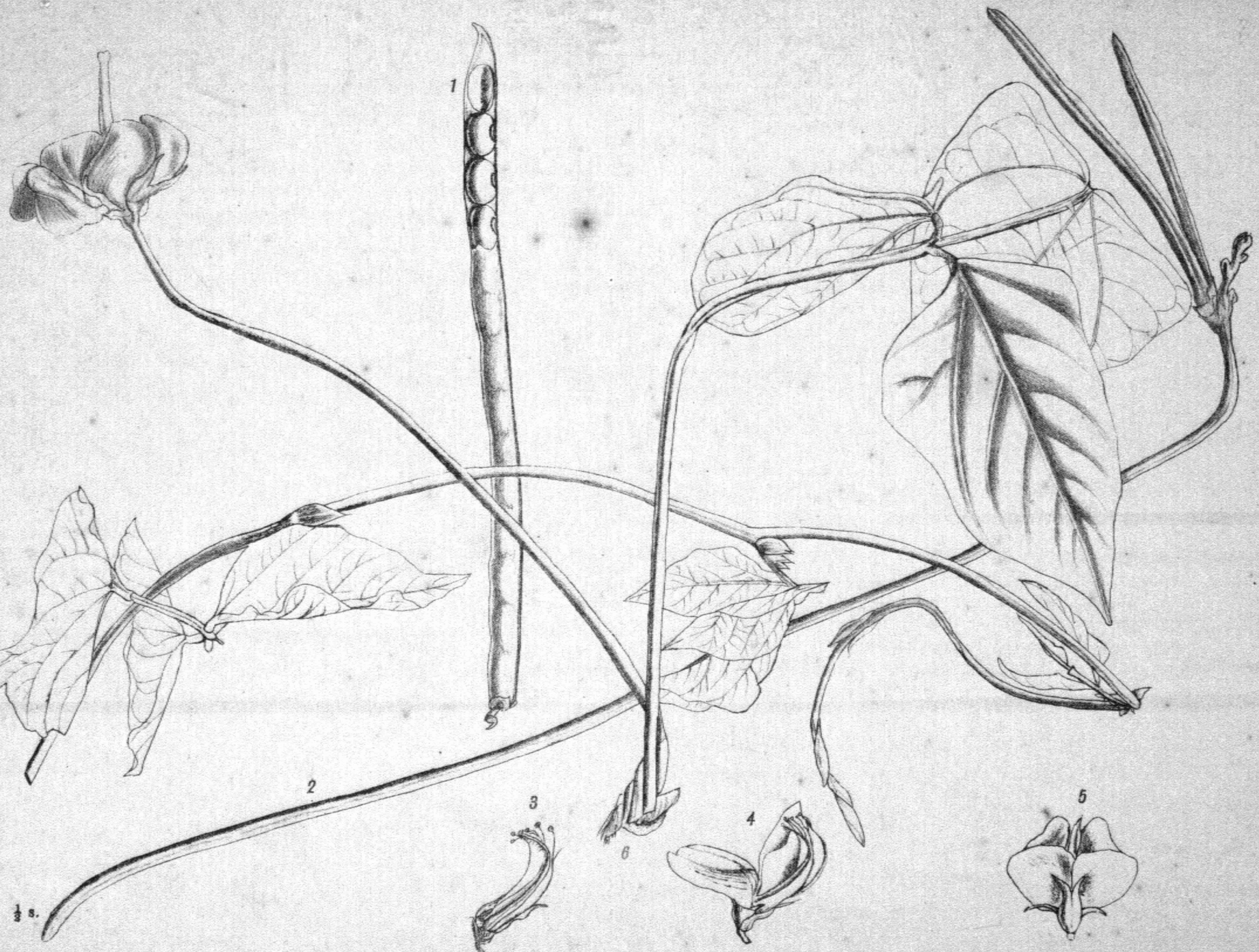
† See pages 37 and 39 of Part I.



VIGNA CATIANG, ENDL.

Drawn by H. Hormuzji

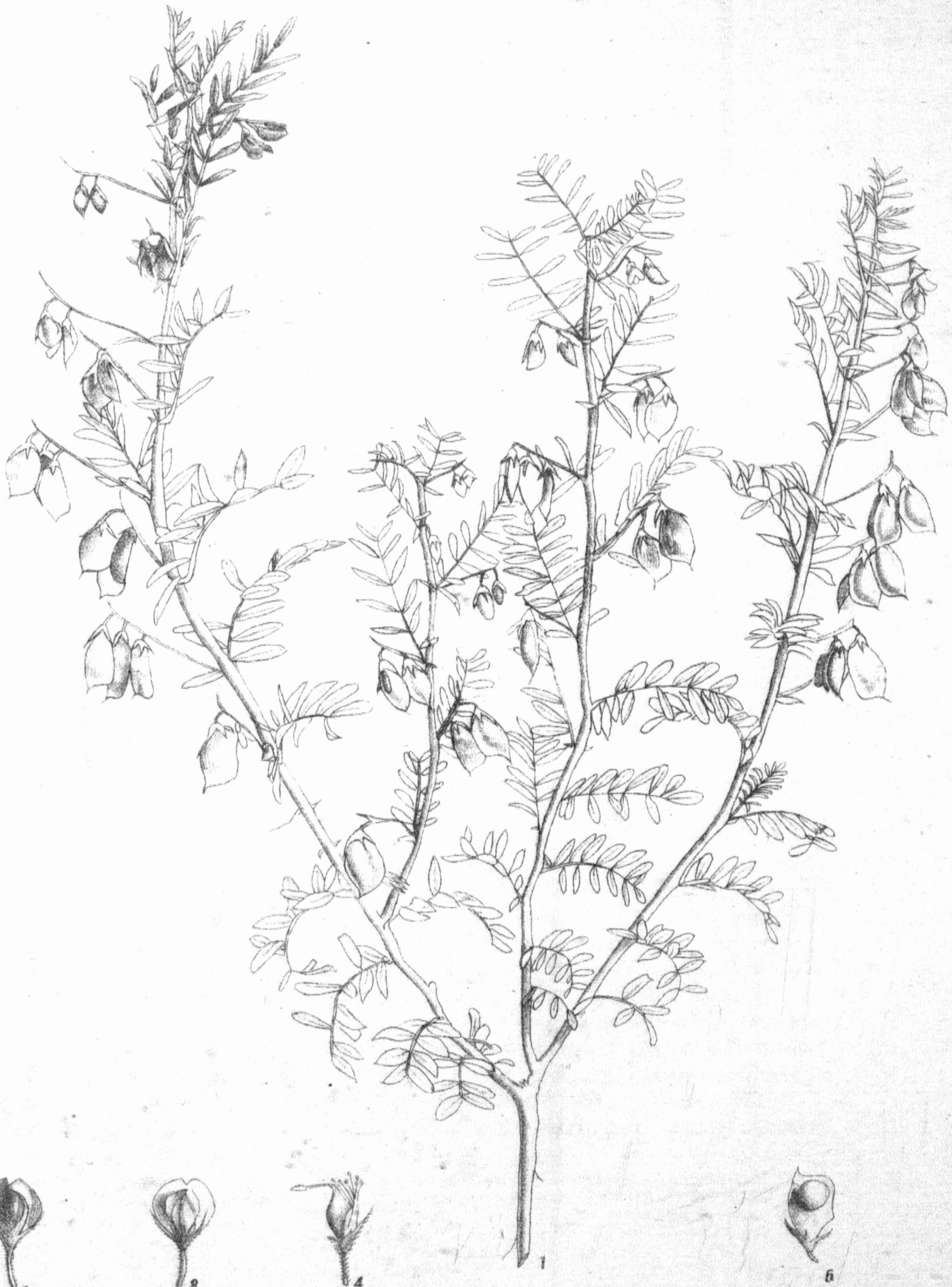
Litho. T. C. Press, Roorkee.
Thos. D. Bona, *Supdt.*



VIGNA CATIANG, ENDL.
VAR.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bona. Supdt.



ERVUM LENS, L.

Drawn by M. Hermanjt.

Litho T. C. Press, Roorkee.
Thos. D. Bona, *Supdt.*

ERVUM LENS, *Linn.**

[*Vide* Plate XXXI].

ENGLISH, lentil; VERNACULAR, masur.

Description.

Natural order *Leguminosæ*, sub-order *Papilionaceæ*, tribe *Viciæ*. A small softly pubescent herb. Stems erect, 1-2 ft., much branched from the base, furrowed. Leaves alternate, nearly sessile, with spreading lanceolate acute stipules at the base, pinnate, about 2 in. long, rachis setiform at the apex or terminating in a tendril or with an odd leaflet; leaflets in pairs of 4-7, sessile, pubescent, lanceolate, entire, often mucronate at the apex. Racemes 2-4-flowered; peduncles about as long as the leaves and extended some distance beyond the flowers. Calyx-tube short, campanulate, teeth linear, twice as long as the tube, clothed with long silky hairs. Corolla papilionaceous, a little longer than the calyx teeth, pale purple; standard suborbicular, emarginate, mucronate, with a short broad claw; wings spathulate with spreading limbs, the claws with prominent hooked processes which fit into the sides of the keel; keel petals a little shorter than the wings. Stamens diadelphous. Style curved upwards, bearded on its inner side. Pod rhomboid-oblong, about ½ in. long, smooth, compressed, 2-valved, tipped with the base of the style. Seeds usually 2, compressed, lenticular, marble-spotted.

Origin.

According to Decandolle† this plant is a true native of Western Asia, Greece, and Italy; at a very early period it appears to have been brought to Egypt as a cultivated plant, and from this centre to have spread to Europe westward and to India eastward.

Season.

Distribution.

Area.

Lentils are grown as a cold weather crop under much the same conditions as peas. Their cultivation is most extended in the damper parts of the Provinces. In the Tarai district the area under them constitutes nearly 7 per cent. of the total rabi cropped area; in the Rohilkhand Division it amounts to 2 per cent.; and in the districts of the Benares Division to 1·3 per cent. In no other division does it reach so high a proportion as 1 per cent., being next largest in the Meerut and Allahabad Divisions (0·8 and 0·7 per cent.), and smallest in the Agra and Jhansi Divisions (0·1 and 0·3 per cent.), which together comprise the driest tract in the Provinces. Taking the 30 temporarily settled districts as a whole, masúr is grown on almost exactly 1 per cent. of the total rabi cropped area.

Soils.

It is sown in all kinds of soils, but chiefly in low-lying land. It is comparatively seldom grown after an autumn fallow, but most commonly follows early rice, being often sown while the rice stalks are standing, and allowed to grow up amongst them. Three ploughings are as a rule sufficient.

Ploughing.

Sowing.

Outturn.

The quantity of seed sown per acre varies with the condition of the ground, but is commonly about one maund. The average produce from unirrigated land is from 6½ to

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* **References**:—Royle Ill. 200; Hook. Fl. Brit. Ind. ii. 179; Baden-Powell Punj. Prod. 241; Gaz. N.-W. P. Vol. x. 694; DC. L'Orig Pl. Cult. 257. *Lens esculenta*, Mœnch Method 131; Bentley and Trimen Med. Pl. 76. *Cicer Lens*, Willd.; Roxb. Fl. Ind. iii. 324.

† DC. L'Orig. Pl. Cult. l. c.

8 maunds grain, but with irrigation from 10 to 12 maunds would not be an excessive outturn.

Average area.

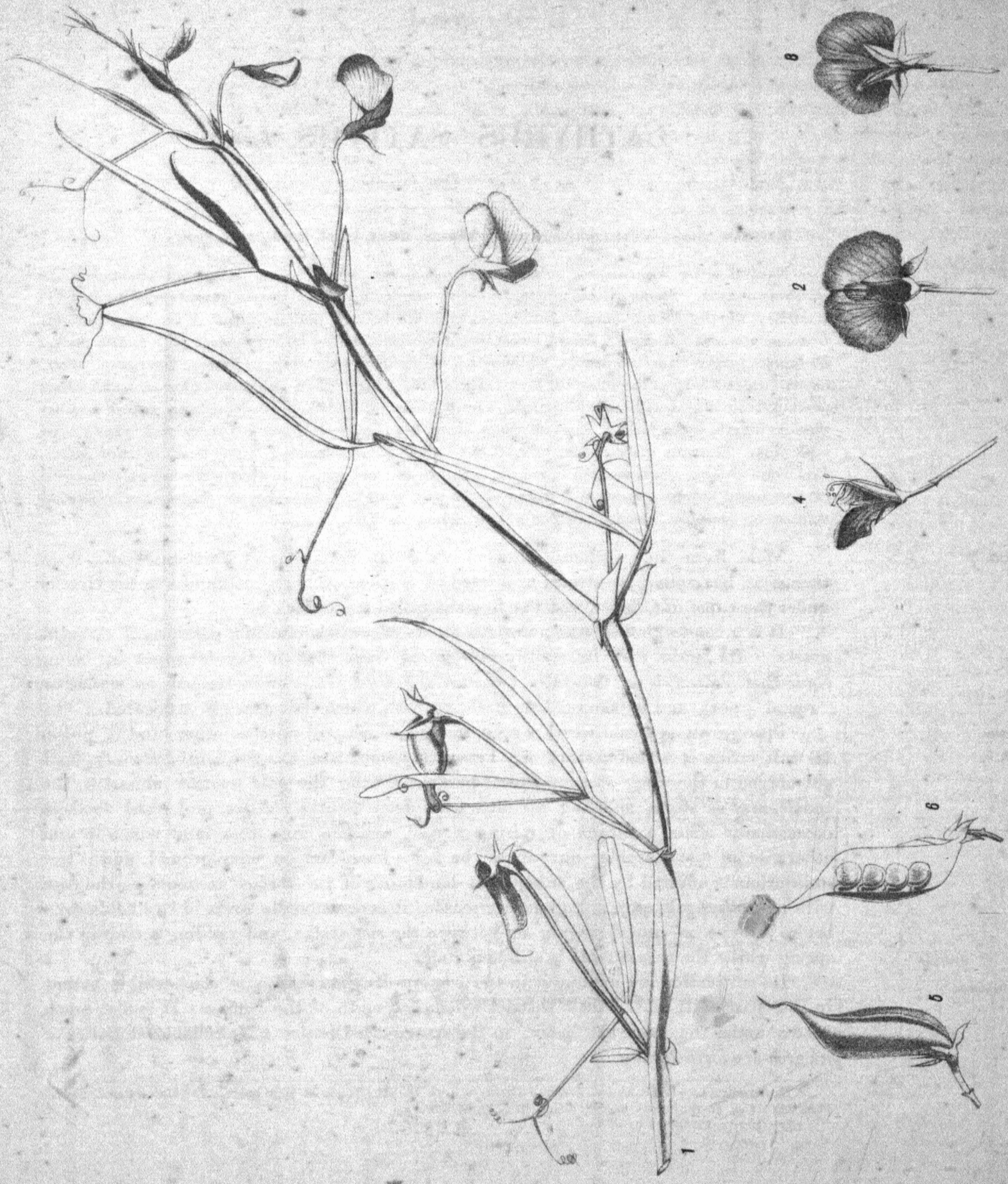
The average area under masúr in the 30 temporarily settled N.-W. Provinces Districts as deduced from the agricultural returns of the last three years, is shown below division by division :—

	Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur District.	Benares Division, including Azamgarh, Gorakhpur, and Basti Districts.	Jhansi Division.	Kumaun Division, including Tarai District only.	Total.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
Irrigated, ...	6,987	1,281	926	332	4,562	1,192	741	15,961
Dry, ...	13,155	41,157	1,673	14,964	22,151	1,064	4,100	98,264
Total, ...	20,142	42,388	2,599	15,296	26,713	2,256	4,841	1,14,225

Explanation of Plate XXXI.

1. Entire plant, (nat. size.)
2. Flower, back view, } enlarged.
3. Ditto, front view, }
4. Flower, with petals removed, } enlarged.
5. Single pod, }

Drawn from a living specimen gathered at Saháranpur.



LATHYRUS SATIVUS, L.

Drawn by H. Hormusji.

Litho T. C. Press, Roorkee.
Thos D. Bona, *Supdt.*

LATHYRUS SATIVUS, *Linn.*

[*Vide* Plate XXXII].

ENGLISH, none; VERNACULAR, **kasári, kassar, tiura, tiuri, latri** (Azamgarh).

Description.

Natural order *Leguminosæ*, sub-order *Papilionaceæ*, tribe *Vicieæ*. A smooth procumbent or climbing annual. Stems quadrangular, two of the angles winged. Leaves pinnate, ending in trifid tendrils; stipules broad, entire, acuminate, sagittate below; petiolos about 1 in. long, winged, broader upwards; leaflets 2, linear lanceolate, acuminate, entire, on very short pale tumid stalks. Peduncles longer than the petiole, 1-flowered. Calyx teeth spreading in flower, lanceolate, acute, about twice as long as the tube, the lowest one a little longer than the rest. Standard and wings peacock-blue tinged with reddish purple, rarely white; standard about ¾-in. long, rather broader than its length, emarginate; claws of wings incurved; keel petals somewhat twisted, pale tinged with pink. Stamens diadelphous, tube of the united ones truncate. Style bent, bearded below. Pod ovate oblong, about an inch in length, compressed, and with a conspicuous wing on either side of the dorsal suture. Seeds 4-5 filling up the pod, ovate or wedge-shaped, flattened or somewhat concave on two sides, black, brown or yellowish and marbled.

Orgin.

Wild from the southern Caucasus or Caspian Sea as far as Northern India, from thence it has spread westward as a weed of cultivation. It was known to the Greeks under the name of *lathyros*, and the Romans called it *cicercula*.†

It is a coarse kind of pea, notorious for its effect in producing paralysis if eaten in excess. Its grain may be readily recognized from that of the true pea by being somewhat flattened on two sides (whence the true pea is often termed *gol mattar* or "round" pea), and by the reddish marbling with which its surface is variegated.

Season.

Soil.

It is grown as a cold weather crop on land which will raise no other kind of pulse. Its cultivation is commonest on very heavy clay soils, and it is frequently sown on land submerged in the rainy season, which hardens during the cold weather almost to the consistency of stone, splitting up into long deep fissures. After prolonged floods it occasionally offers a means of raising a cold weather crop from land which would otherwise be unculturable, since it can be sown broadcast on miry ground, and is not so injuriously effected by the subsequent hardening of the surface as would be the case with any other rabi crop. For similar reasons it is occasionally sown in rice fields even before the rice is cut, springing up between the rice stalks, and yielding a crop in the spring whilst the rice stubble is still standing.

Distribution.

Its cultivation is commonest in the eastern districts, and is of considerable extent in that part of the Allahabad District which lies south of the Jumna. It is also much grown under the name of "latri" in the Azamgarh District. No reliable statistics of its area are forthcoming.

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* **References**:—Roxb. Fl. Ind. iii. 322; Benth. in Royle Ill. 200; Hook. Fl. Brit. Ind. ii. 179; Baden-Powell Punj. Prod. 242; Gaz. N.-W. P. Vol. x. 694; DC. L'Orig. Pl. Cult. 88.

† DC. L'Orig. Pl. Cult. l. c.

The remarkable part connected with it is its undoubted tendency to produce paralysis, which has been ascribed to the nitrogenous constituents in which it is exceptionally abundant. The widespread occurrence of paralysis in Sindh after a season of extensive inundations, in which kasári was grown on an exceptionally large scale, attracted considerable observation, and the Settlement Officer of Azamgarh reports that similar effects are to be noticed in the Azamgarh District, cases of paralysis being far from uncommon in villages where kasári forms an important item of diet. It may also be noticed that the occurrences of some cases of paralysis in the military station of Almora some few years ago was traced to the fraudulent admixture of kasári with the gram supplied for the use of the troops.

Colonel Sleeman writes as follows of the effect of the large consumption of kasári in eastern villages of Oudh :—

" In 1829 the wheat and other spring crops in this and the surrounding villages were destroyed by a " severe hail-storm; in 1830 they were deficient from the want of seasonable rains, and in 1831 they were " destroyed by blight. During these three years the kasári which, though not sown of itself, is left carelessly " to grow among the wheat and other grain, and given in the green and dry state to cattle, remained " uninjured, and thrived with great luxuriance. In 1831 they reaped a rich crop of it from the blighted " wheat fields, and subsisted upon its grain during that and the following year, giving the stalks and leaves " only to their cattle. In 1833 the sad effects of this food began to manifest themselves. The younger " part of the population of this and the surrounding villages, from the age of thirty downwards, began to " be deprived of the use of their limbs below the waist by paralytic strokes, in all cases sudden, but in some " more severe than in others. About half the youth of this village of both sexes became affected during " the years 1833 and in 1834; and many of them have lost the use of their lower limbs entirely, and are " unable to move. The youth of the surrounding villages, in which kasári from the same causes formed the " chief article of food during the years 1831 and 1832, have suffered in an equal degree. Since the year " 1834 no new case has occurred, but no person once attacked had been found to recover the use of the " limbs affected, and my tent was surrounded by great numbers of the youth in different stages of the disease, " imploring my advice and assistance under this dreadful visitation. Some of them were very fine-looking " young men of good caste and respectable families, and all stated that their pains and infirmities were " confined entirely to the joints below the waist. They described the attack as coming on suddenly, often " while the person was asleep, and without any warning symptoms whatever, and stated, that a greater " portion of the young men were attacked than of the young women. It is the prevailing opinion of the " natives throughout the country, that both horses and bullocks which have been much fed upon kasári are " liable to lose the use of their limbs, but if the poisonous qualities abound more in the grain than in the stalk " or the leaves, man, who eats nothing but the grain, must be more liable to suffer from the use of this food " than beasts, which eat it merely as they eat grass or hay."

Explanation of Plate XXXII.

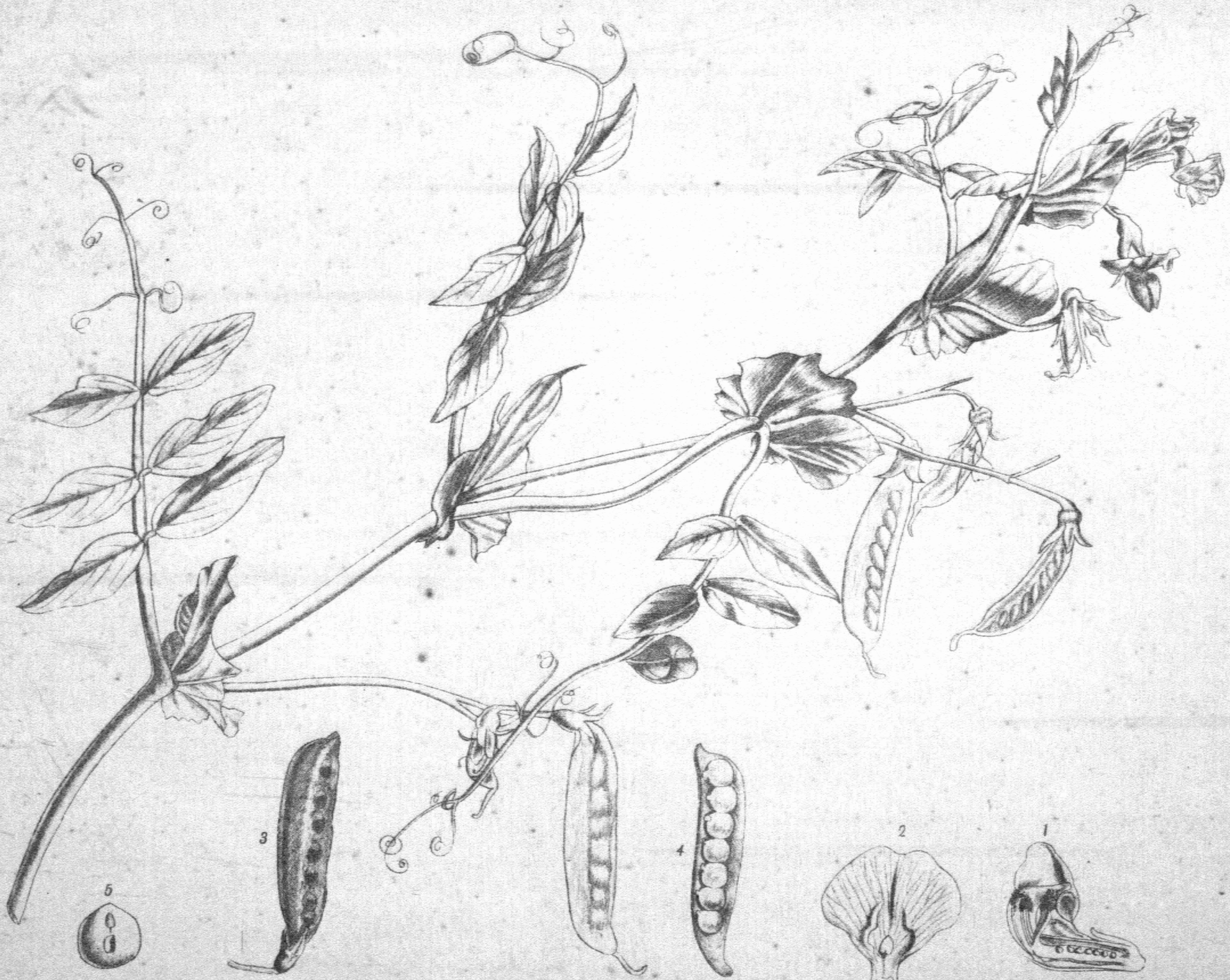
1. Terminal portion of plant,
2. Flower, front view,
3. Ditto, back view,

} nat. size.

4. Flower, with some of the petals removed,
5. Pod,
6. Ditto, with one valve removed,

} nat. size.

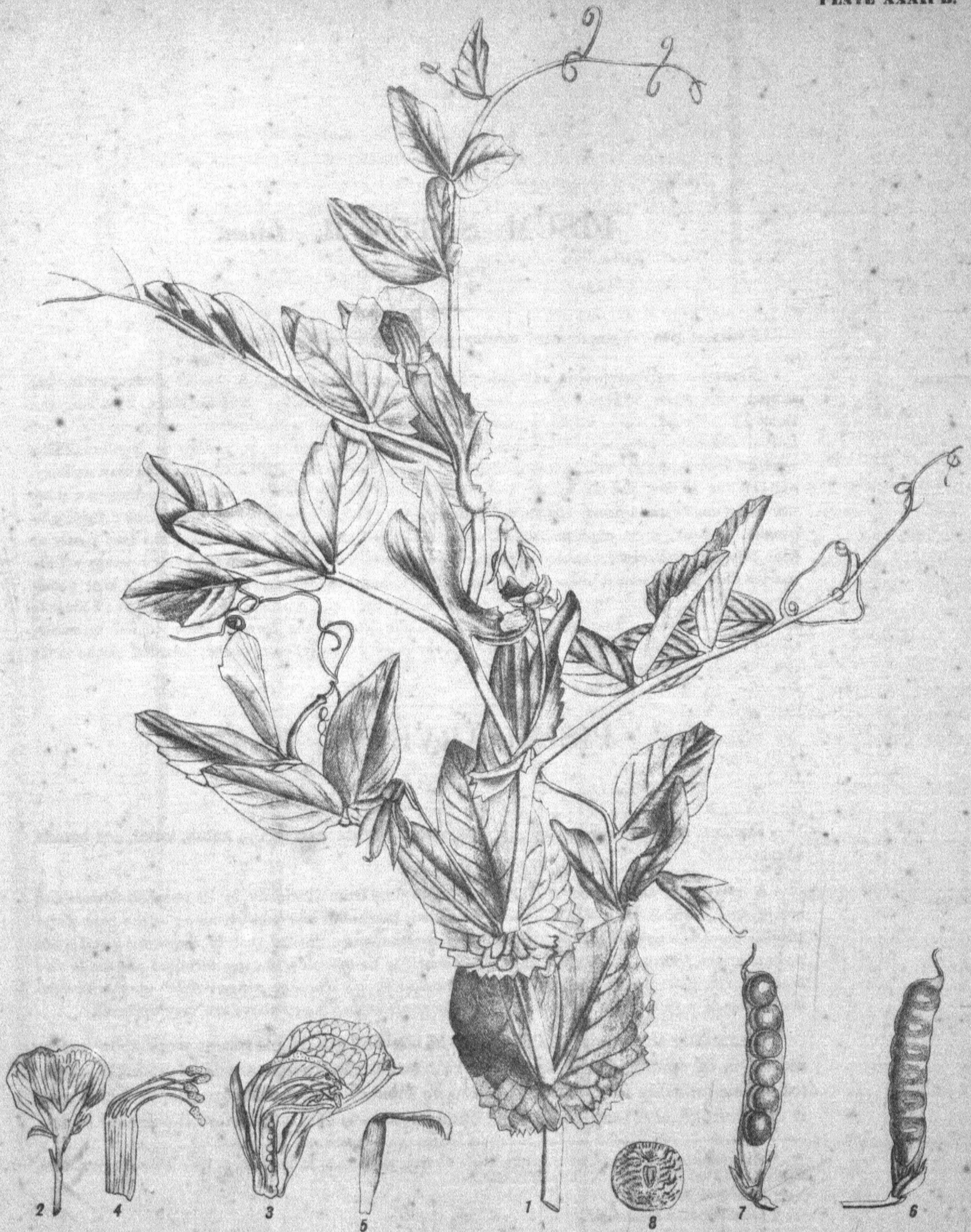
Drawn from a living specimen gathered at Saháranpur.



PISUM SATIVUM, LINN.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.
Thos. D Bona, Supdt.



PISUM ARVENSE, LINN.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

PISUM SATIVUM, *Linn.**

[*Vide* Plate XXXIIA.]

ENGLISH, **pea**; VERNACULAR, **mattar, gol mattar**; Sanscrit, **harenso.**†

Description.

Natural order *Leguminosæ*, sub-order *Papilionaceæ*, tribe *Viciæ*. A smooth glaucous climbing annual with white flowers. Stems stout, terete, hollow, flexuose. Stipules large, 2 in. long and about 1¼ in. broad, semi-cordate, dentate towards the base, and with a minute mucro at the apex. Leaves alternate pinnate, bi-tri-jugate, the common petiole ending in a more or less branching tendril; leaflets nearly sessile, ovate, entire or obscurely dentate. Flowers large, irregular, axillary, solitary (in Indian plants), white; peduncles a little longer than the stipules, ending in a short stoutish seta; bracts minute caducous; pedicle ¼ in. Calyx gamosepalous, persistent; tube gibbous at the back, segments ½ in., about equal in length, lanceolate, acuminate, the two posterior ones broader. Standard broadly obcordate, mucronate; claw short, semi-tubular; wings a little shorter than the standard, oblong falcate, attached to and converging round the keel; keel petals obtuse, cohering and forming a wing-like ridge along the top. Stamens 10, diadelphous; filaments connate in a truncate tube for more than half their length, the free portions dilated upwards. Ovary single, 1-celled, oblong, compressed; style thick laterally, compressed, bearded on the inner side. Seeds globose, white.

PISUM ARVENSE, *Linn.*‡

[*Vide* Plate XXXIIB.]

ENGLISH, **field pea**; VERNACULAR, **desi mattar, chota mattar,** also **kalon, kulai,** and **batana** (Jaunsar).§

Description.

A variety or sub-species of *P. sativum*, differing from it chiefly by its purplish flowers and compressed marbled seeds. It is a less robust plant, the stems are more slender; at the base of the stipules there is a reddish purple blotch of exactly the same tint as that of the wing petal; the peduncles are shorter, the upper ones falling short of the stipules, the free terminal portion is also much shorter; the flowers are smaller; the standard is pale lilac, the wings reddish purple, and the keel petals of a yellowish white colour; and the seeds as mentioned above are very different.

Origin.

Regarding the origin of *P. sativum*, M. Decandolle, in his recent work above referred to, is of opinion that before being cultivated it existed as a wild plant in W. Asia, extending probably from the S. Caucasus to Persia; that the Aryan people introduced it into Europe, also that it probably found its way to N. India before the arrival of the

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* **References**:—Roxb. Fl. Ind. iii. 321; Royle Ill. Him. 200; Hook. Fl. Brit. Ind. ii. 181; Boiss. Fl. Or. ii. 622; Baden-Powell Punj. Prod. 242; DC. L'Orig. Pl. Cult. 262.

† Piddington Index p. 70.

‡ See above under *P. sativum*.

§ Atkinson in Gaz. N.-W. P. l.c.

eastern Aryans. The origin of *P. arvense* has not been ascertained for certain. According to the researches of M. Decandolle, it would appear that Italy was most likely its original home, for in no other country does it grow in such a spontaneous manner in localities far removed from cultivation. Royle, however, believed it to be wild in the khádir land of the Jumna near Dehli.*

Both kinds are largely grown in some of the districts of these Provinces; the round-seeded one is, however, by far the more valuable and prolific of the two, and includes the white peas known as *kábli* and *patnai* (Azamgarh District) according as they are of large and small size. The greenish coloured peas which are included in the second species are usually known as *mattar* or *chattar*, but must be carefully distinguished from the *kasári* (*Lathyrus sativus*), an entirely different species of pea, to which they bear some resemblance, and which is cultivated much after the same fashion.

Seasons. Peas are a rabi crop, and are sown from the end of September to the middle of October, and reaped in March. In the western and central parts of the Provinces they are most commonly grown as a second crop after indigo or rice in the preceding kharif,

Distribution. and since they are hardly ever irrigated their average outturn is very small. With the exception indeed of the Meerut District, in which the area under peas amounts to nearly 4 per cent. of the rabi cropped area, the cultivation of peas in the parts of the Provinces which lie west of Allahabad is on a very trifling scale, only the common varieties being grown. In the Allahabad District the area under peas rises to 5·9 per cent. on the rabi cropped area, and in the districts of the Benares Division and of the east of Oudh, their cultivation plays an important part in the agriculture of the district, the white varieties being largely grown with careful tillage and irrigation. In Azamgarh, Gorakhpur and Basti, the area under peas amounts to 13·4 per cent. on the rabi cropped area, and in wet seasons, when the ground is too damp to allow of wheat being sown in time, peas are often sown in its place.

Cultivation. As a rule they are sown, like gram, on heavy ground, and the coarser varieties do not require, or at all events do not receive, very careful preparation. Manure is hardly ever, if ever, used. They are sown broadcast, and ploughed in at the rate of 1½ maunds per acre, if of the fine, and at 1 maund per acre, if of the coarse kind.

Irrigation. They do not receive much irrigation except in Oudh and the Benares Division, where nearly the whole of the crop receives at least one watering.

Harvesting. They are harvested in the same manner as other rabi crops, but supply a certain amount of food long before they are cut and carried, the green pods being regularly picked for home consumption from the time when they first reach their full size.

Injuries. Like gram they suffer (especially the white varieties) from frost and from the ravages of a caterpillar called the "Bahadura."

Cost of cultivation. The cost of production per acre may be put at Rs. 12-13 for the coarse kind when no irrigation is used, and Rs. 17-13 for the fine kinds, assuming that two waterings are given and the land is of rather higher rent.

Outturn. The average outturn in the Meerut, Rohilkhand, Agra, Allahabad and Jhansi Divisions is about 10 maunds per irrigated, and 7 maunds per unirrigated, acre. In the Oudh

* Ill. Him. l.c.

and the Benares Divisions it rises to 16 maunds in the first, and 8 maunds in the second case. The outturn of chaff (*bhúsa*) may be taken as equal to that of grain.

Average area.

The average area under peas in the 30 temporarily settled N.-W. Provinces districts during the year 1879-80 and 1881 is shown below by divisions, but is believed to include a certain amount of land under kasári, which is largely cultivated in the Allahabad Division :—

	Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur District.	Benares Division, including Azamgarh, Basti and Gorakhpur Districts only.	Jhansi Division.	Kumaun Division, including Tarai District only.	Total.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
Irrigated, ...	18,474	725	3,307	21,918	2,17,057	553	...	2,62,034
Unirrigated, ...	28,876	9,598		20,865	54,850	692	120	1,17,818
Total, ...	47,350	10,323	6,124	42,783	2,71,907	1,245	120	3,79,852

Explanation of Plate XXXIIA.

1. Vertical section of flower.
2. Standard.
3. Pod.
4. Pod with one valve removed.
5. Seed.

Drawn from a specimen obtained from Dehli.

Explanation of Plate XXXIIB.

1. Upper part of plant, (nat. size.)
2. Flower seen from behind, } enlarged.
3. Ditto vertical section, } enlarged.
4. Portion of staminal tube, } enlarged.
5. Pistil, (enlarged.)
6. Pod, } nat. size.
7. Ditto with one valve removed, } nat. size.
8. Seed, (enlarged.)

Drawn from a living specimen raised at Saháranpur from Bulandshahr seed.

CAJANUS INDICUS, *Spreng.**

[*Vide* Plates XXXIII. and XXXIV.]

ENGLISH, **Pigeon-pea**; VERNACULAR, **arhar, thur, dal**; Sanscrit **arhuku.**†

Description. Natural order *Leguminosæ*, tribe *Phaseoleæ*. An erect shrubby plant. Stems 5-10 ft. high; branches many, sulcate, silky. Leaves trifoliolate; stipules minute, lanceolate, cordate, soon falling; petioles channelled striated; leaflets with minute stipels, entire, oblong lanceolate, acute, silky especially on the lower surface. Bracts downy. Flowers irregular papilionaceous, in loose corymbose racemes, sometimes forming a terminal panicle. Calyx ¼ in. long; tube campanulate, glandular puboscent; teeth short. Corolla three times as long as the calyx; standard yellow (*C. flavus*) or yellow with red veins (*C. bicolor*). Stamens diadelphous. Pods 2-3 in. long, narrowed at both ends, constricted between the seed, blotched with reddish-purple streaks. Seeds 3 or 4, about the size of small peas, somewhat compressed, smooth, varying in colour from yellow and red to light brown or even blackish.

Origin. M. Decandolle (L'Orig. Pl. Cult.) gives reasons which indicate equatorial Africa as its original home.

Varieties. The two varieties alluded to under the names of *C. flavus* and *C. bicolor* are known respectively as *thur* and *arhar*; the latter is the one most commonly cultivated in these Provinces. It is easily distinguished by having its standard veined with purple instead of being plain yellow as in thur. Thur takes the place of arhar over a great part of the Central Provinces, and is distinguished there by its much shorter habit of growth, and by its flowering at least three months earlier than arhar. There are several other varieties differing more or less in the colour and size of the seeds.

Distribution. The area in the N.-W. Provinces 30 temporarily settled districts on which arhar is grown is very large, amounting to some 35¼ lakhs of acres, on not more than 1¼ lakhs of which it is, however, grown as the sole crop. It is therefore important merely as forming a subordinate crop with juár, bájra and cotton, and not on account of the area which it occupies for itself. Judging from the returns of the 30 temporarily settled N.-W. Provinces districts, out of the total area on which arhar is grown, juár-arhar occupies $\frac{15}{85}$, bájra-arhar $\frac{9}{85}$, cotton-arhar $\frac{8}{85}$, and arhar alone only $\frac{1}{85}$. Its distribution follows therefore that of its principal crops, and since two of them, cotton and bájra, are principally grown in the west and south of the Provinces, the area on which arhar is grown is largest on these tracts, although perhaps it flourishes best in the eastern districts, where it has not to risk any injury from frost.

Mixtures.

Season. It occupies the ground for a longer period than any other crop except sugar-cane, being sown at the commencement of the rains, and not cut till the rabi harvest time in

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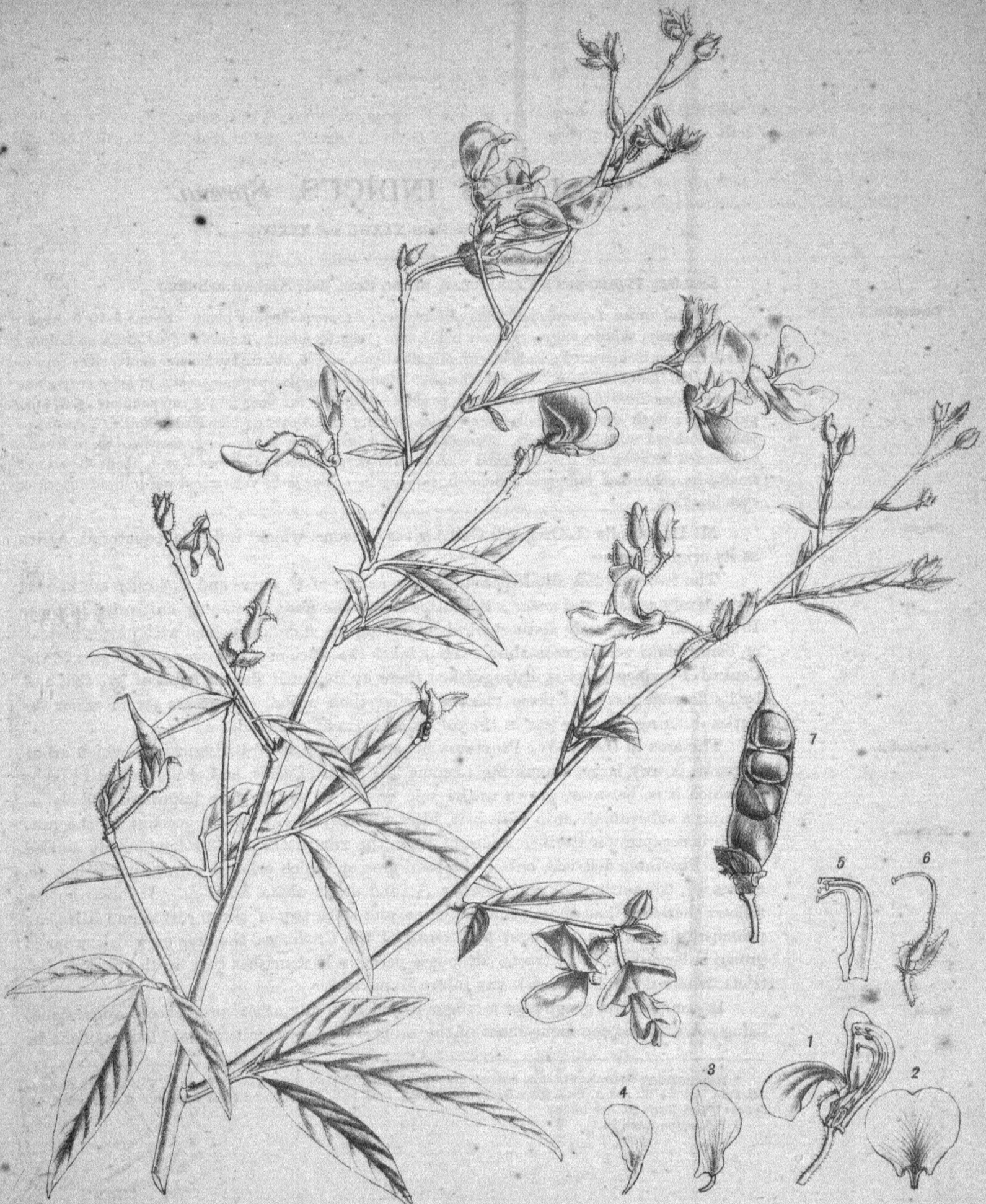
* **References**:—Hook. Fl. Brit. Ind. ii. 217; DC. L'Orig. Pl. Cult. 266; Gaz. N.-W. Prov. Vol. x. 696; *C. flavus* DC. Prod. ii. 406; W. and A. Prod. 256; Baden-Powell Punj. Prod. 242; Drury Useful Pl. of India 94; *C. bicolor* DC. l.c. *Cytisus Cajan*, Roxb. Fl. Ind. iii. 325.

† Piddington Index 28.



CAJANUS INDICUS, SPRENG.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bonn, *Supdt.*

CAJANUS INDICUS, SPRENG.
VAR. BICOLOR.

Drawn by H. Hermanjl.

Litho T. C. Press, Roorkee,
Thos. D. Bens, Supdt.

March and April. An early variety grown in the Azamgarh district is said to ripen in February, but as a general rule at least nine months intervene between sowing and reaping. It is said not to impoverish the soil on which it is grown, or at all events to compensate for the loss it occasions by drawing up fresh food substances from the subsoil, by opening up and aerating the ground with its deep penetrating roots, and by the return it makes in the shape of fallen leaves. These advantages are supposed indeed to be generally characteristic of the leguminous order of plants.

Soils. The soils on which it is grown vary with the requirements of the crop which it accompanies. It will occupy, if sown with juár, some of the heaviest, and if sown with bájra, some of the lightest, soils in the Provinces. But it prefers a light moist soil, which allows its roots to penetrate downwards without check, and although not requiring manure, it only attains luxuriance when grown on either freshly broken or well fertilized land.

Sowing. The preparation of the land is similar to that for juár, bájra, or cotton, and the seed is sown broadcast if grown alone or with juár or bájra, and generally in lines about 15 feet apart when it is associated with cotton. The amount of seed sown to the acre is about 6 seers if it forms the sole crop on the ground, and 2 seers when it accompanies other crops.

Irrigation. Arhar is seldom irrigated on its own account, since the depth to which its roots penetrate enable it to draw moisture from a soil apparently parched, and to keep green during a rainless six months from October till March. If easily available, a watering is sometimes given it as a protection from frost, the effect being not only to give the plants strength to resist the frost, but also to hinder to some degree the chilling of the surface by radiation.

Weeding. It receives no weeding apart from its principal crop. When grown alone a plough is sometimes run over the field between the young plants to break up the surface soil when caked by the rain and sun.

Harvesting. It is cut with the rabi crops and allowed to be stacked on the threshing floor until the threshing and cleaning of the former are completed. The leaves and pods are first of all stripped off the stems and then heaped together, and the grain threshed out either by bullock treading or by being beaten with a stick. The leaves form an excellent fodder. The stalks are valuable for roofing, basket making, and above all for making the tubular wicker work fascines (*bira* or *ajar*) which are used to line earthen wells in order to prevent the earth from falling in.

Injuries. Frost is the principal enemy with which arhar has to contend. A single cold night often utterly ruins the crops of a whole district, and in the following morning the cultivators may be seen sadly cutting down the withered plants as fodder for their cattle. Its liability to damage is however greatly dependent on the strength of the plants, and hence the crop grown on manured land near the village site will often remain green and flourishing after a frost which has withered up those on outlying fields. The practice of irrigating as a safeguard against frost has been already noticed.

Cost of cultivation. The cost of cultivation may be assumed to be almost the same as that of juár or bájra.

Outturn. District estimates agree tolerably closely in giving 7 maunds of grain and 16 maunds

bhúsa as the average produce per acre of land on which arhar is the sole crop. When associated with other crops its outturn varies enormously, being anything between 1 and 5 maunds of grain to the acre.

Average area.

The average area during the last 3 years on which arhar was grown in the 30 temporarily settled districts of the N.-W. Provinces and Oudh is shown below by Divisions :—

	Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur District.	Benares Division, including Azamgarh, Basti and Gorakhpur Districts only.	Jhansi Division.	Kumaun Division, including Tarai District.	Total.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
Arhar alone.								
Irrigated, ...	89	98	319	156	15,619	6	4	16,291
Unirrigated, ...	4,587	4,008	1,724	12,920	86,674	135	1,010	1,11,058
Total, ...	4,676	4,106	2,043	13,076	1,02,293	141	1,014	1,27,349
Juár-arhar.								
Irrigated, ...	7,890	236	24,139	10,590	886	153	...	43,894
Unirrigated, ...	1,84,322	88,241	5,36,735	6,01,435	4,408	84,449	2	14,99,592
Total, ...	1,92,212	88,477	5,60,874	6,12,025	5,294	84,602	2	15,43,486
Bájra-arhar.								
Irrigated, ...	920	405	1,978	809	49	1,058	...	5,219
Unirrigated, ...	65,724	2,60,352	3,97,240	2,09,948	3,556	39,983	2	9,76,805
Total, ...	66,644	2,60,757	3,99,218	2,10,757	3,605	41,041	2	9,82,024
Cotton-arhar.								
Irrigated, ...	34,010	827	27,082	4,244	207	467	6	66,843
Unirrigated, ...	81,599	1,04,051	2,53,103	3,12,519	3,226	53,715	406	8,08,620
Total, ...	1,15,609	1,04,878	2,80,185	3,16,763	3,433	54,183	412	8,75,463
Grand Total, ...	3,79,141	4,58,218	12,42,320	11,52,621	1,14,625	1,79,967	1,430	35,28,322

Explanation of Plate XXXIII.

1. Flower with some of the petals removed, } slightly enlarged.
2. Standard, }
3. A wing petal, }
4. A keel petal, } slightly enlarged
5. Portion of staminal tube, }
6. Pistil. }
7. Pod with one valve partially removed.

Drawn from a living specimen gathered in Dehra Dún.

Explanation of Plate XXXIV.

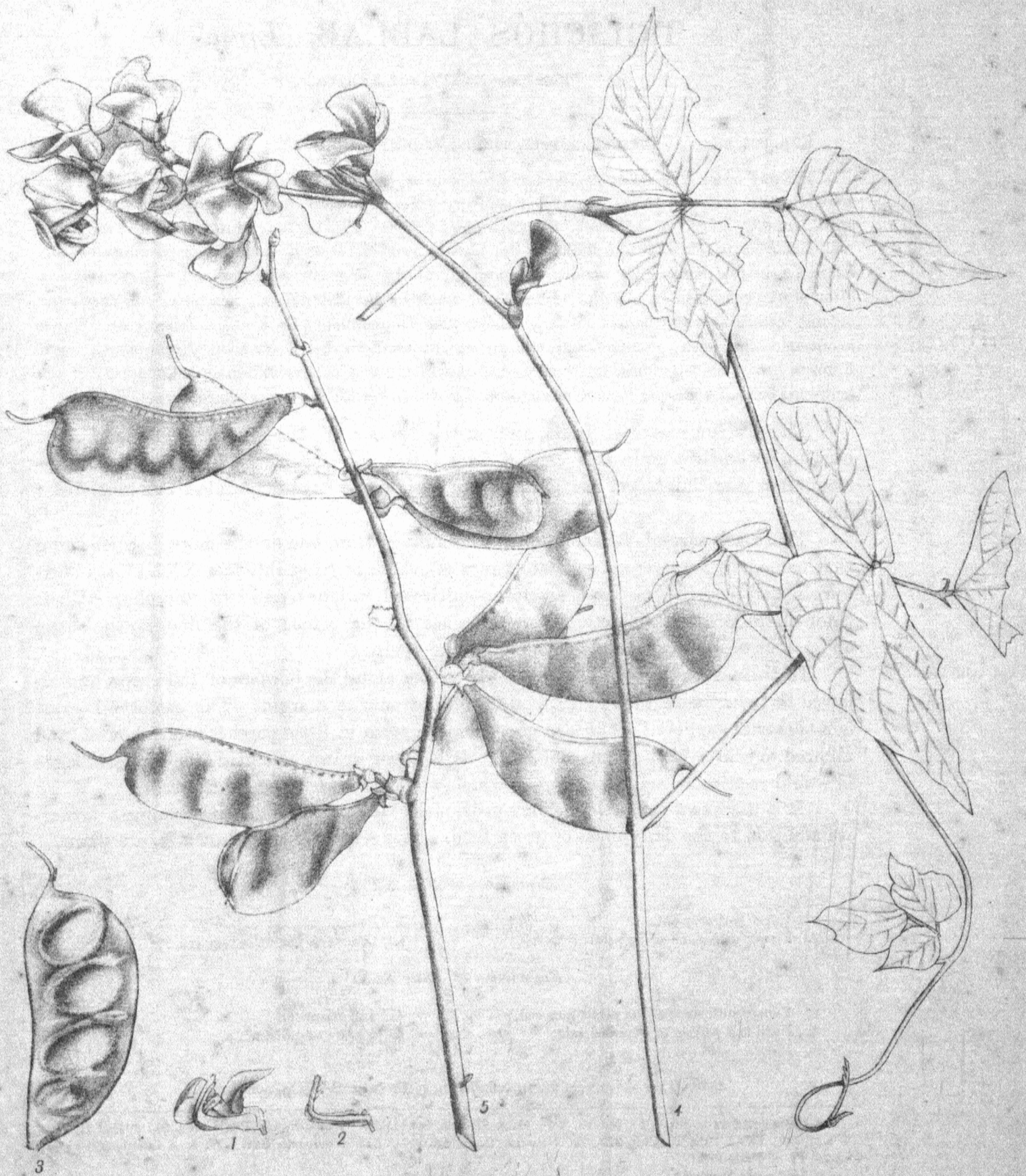
1. Upper portion of plant.
2. A lower leaf.
3, 4, 5. Flower, front side, and back views.
6. Ditto, with some of the petals removed.
7. Staminal tube.
8. Ripe pod.
9. Ditto, with one valve removed.

Drawn from a living specimen gathered at Sahárunpur.

DOLICHOS LABLAB, LINN.

Drawn by H. Hormuzji

Litho. T. C. Press, Roorkee.
Thos. D. Bone, *Superd.*



DOLICHOS LABLAB, L.
VAR. PURPUREUS.

Drawn by H Hormusji.

Litho. T. C. Press, Roorkee.
Thos. D, Bona, *Supdt.*

DOLICHOS LABLAB, *Linn.**

[*Vide* Plates XXXIVA and XXXIVB.]

ENGLISH, none ; VERNACULAR, sém, sémbi ; Sanscrit shimbee.†

Description.

Natural order *Leguminosæ*, division *Papilionaceæ*, tribe *Phaseoleæ*. A twining perennial herb with stipellate trifoliate leaves, young parts downy. Stems pale-coloured, usually scabrid. Stipules small, cordate, lanceolate, reflexed, sub-persistent ; petioles 1½-2 in. long, swollen at the base, channelled above ; stipels minute ; stalks of the leaflets swollen, downy, dark green ; leaflets broadly ovate, or the two lower ones obliquely rhomboid, 2-3 in. long, entire, acuminate. Racemes erect, often leafy, composed of alternate fascicles of white or purplish flower ; bracteoles sub-persistent, oblong, rather shorter than the calyx. Calyx tube campanulate ; teeth short, triangular. Petals about equal in length ; standard with two prominent parallel ridges. Stamens diadelphous. Style filiform, bent. Pods straight or scimitar-shaped, white green or purple, 3-5-seeded, tipped with the hardened base of the style ; margins rugose. Seeds black with the hilum white, or marbled.

Origin.

The *sém* is a native of India, and, in the opinion of M. Decandolle, it must have been under cultivation in this country for a period not less than 3,000 years. Its introduction into China, W. Asia, and Egypt, appears to have taken place at a much later date.

Varieties.

There are several varieties of this climbing bean, one of the more distinct being that named *D. purpureus*, a separate figure of which is given in *Plate* XXXIVB. Roxburgh (l.c.) describes no less than eleven cultivated varieties, and two wild ones. Their chief distinguishing characters have reference to the colour of the flowers, the shape and colour of the pods, and the colour of the seeds.

Method of cultivation.

In these Provinces sém is commonly grown along the borders of tall crops, and allowed to twine itself round the plants standing on the margin. The castor oil plant is a favourite support. It is also occasionally grown in little patches round houses, and allowed to trail over the walls and roof. It is never grown as a field crop by itself, since it would require an artificial support which would add too much to the cost.

It is used as a vegetable, its long pods, picked in unripe condition, forming a favourite addition to the daily mess of green food. It is seldom if ever grown for its grain.

Explanation of Plate XXXIVA.

1. Upper part of plant,
2. Flower with some of the petals removed,

} nat. size.

3. Pod,
4. Ditto with one valve removed,

} nat. size.

Explanation of Plate XXXIVB.

1. Flower with some of the petals removed,
2. Pistil and portion of staminal tube,
3. Pod,

} nat. size.

4. Inflorescence,
5. Cluster of pods,

} nat. size.

Both of the above were drawn from living specimens gathered at Saháranpur.

* **References** :—Roxb. Fl. Ind. iii. 305 ; Hook Fl. Brit. Ind. ii. 209 ; Baden-Powell Punj. Prod. 242 ; Gaz. N.-W. P. Vol. x. 696 ; DC. L'Orig. Pl. Cult. 277. *D. lignosus*, Roxb. l.c. 307 ; *Lablab vulgaris*, Savi ; W. & A. Prod. 250 ; Drury Useful Pl. of India 273.

† Piddington Index 31.

CYAMOPSIS PSORALIOIDES, *DC.*

[*Vide* Plate XXXV.]

ENGLISH, none; VERNACULAR, **guár** (Meerut); **dararhi** (Farukhabad); **kuwara, kauri, syansundari, phaligawar,** and **kachhur** (of sub-montane tract)†, also **khurti** and **khultil‡** (Muttra and Aligarh).

Description.

Natural order *Leguminosæ*, division *Papilionaceæ*, tribe *Galegeæ*. A robust annual, 2-4 ft. high, with erect 4-sided stems, the whole plant clothed with adpressed grey hairs attached by the middle. Leaves trifoliolate, stipules linear, setaceous; petioles 1-2 in., jointed to the stem, channelled above, keeled below; leaflets 2-3, about equal, ovate, acute, somewhat cuneate at the base, incise dentate, stalks of the lateral ones about $\frac{1}{8}$ in. that of the terminal one equal to half the petiole; midrib and principal veins prominent beneath, bifurcating near the margin. Flowers pale purple, arranged in long axillary racemes; bracts long, overtopping the flower buds. Calyx-tube oblique, the three lower teeth setaceous, much longer than the upper. Petals narrow, about equal in length, soon falling off. Stamens monadelphous; anthers apiculate. Style short, incurved, stigma capitate. Pods crowded towards the base, of the peduncle, subtetragonous, septate between the seeds. Seeds brownish grey, compressed, squarrose, about $\frac{1}{6}$ in.

Origin.

This plant is cultivated in many parts of the plains of India from the Himalayas to the Western Peninsula, but has never been met with truly wild. In the "Genera Plantarum" of Bentham and Hooker it is alluded to as an East Indian plant, the only other species being a native of tropical Africa. In all probability *gúar* will be found to have originated from the west.

Variety.

A robust tall-growing variety of this, called Deoband kawára, is often cultivated in the Meerut District, and perhaps in other parts of these Provinces, as a hedge or shelter plant; and apparently it is used only for this purpose. It is supposed to have come originally from Deoband near Saháranpur.

Method of cultivation.

Guár is grown in these Provinces for two very different purposes,—as a vegetable for human consumption, and as a pulse for horses and cattle. For the former purpose it is invariably grown on highly manured land near villages, and assumes a much more luxuriant habit of growth than when grown for cattle. The portion eaten as a vegetable is the pod, which is plucked while green, after the fashion followed with the French beans of English gardens. As a cattle fodder it is grown for its grain, and is then sown on light sandy soil, side by side and often mixed with bájra.

The cultivation of guár as a vegetable is not very common, and is restricted to the market gardeners or "kachi" caste. Its cultivation as a cattle fodder is on the other hand of considerable importance in the districts to the west of the Provinces, where the

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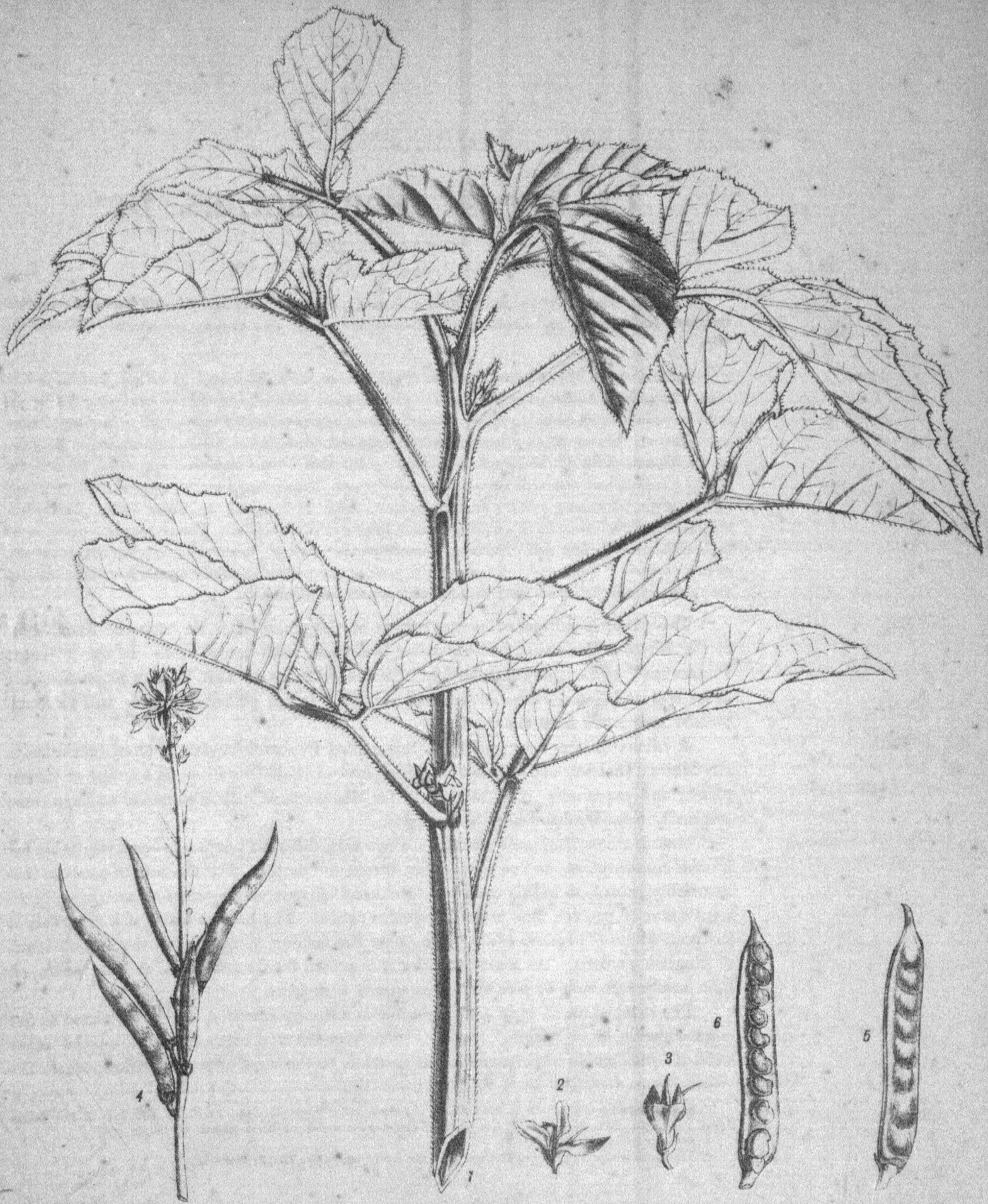
* **References**:—DC. Prod. ii. 216; W. & A. Prod. 197; Wight Ic. 248; Hook Fl. Brit. Ind. ii. 92; Baden-Powell Punj. Prod. 240; Gaz. N.-W. P. Vol. x. 696. *Dolichos fubæformis*, L'Herit.; Roxb. Fl. Ind. iii. 316.

† Atkinson in Gaz. N.-W. P. Vol. x.

‡ This name is also given to *Dolichos uniflorus*, the horse gram of the Madras Presidency.



CYAMOPSIS PSORALIOIDES, DC.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bonn, *Supdt.*

agricultural cattle are of far better quality than the ordinary. Fully half of the agricultural cattle of the districts of the Meerut Division are purchased from the outside, the cultivators of these districts recognizing that it is more profitable to import good animals from tracts specially fitted for breeding, than to attempt to breed them themselves on the limited grazing area at their command. The proportion of imported to home-bred cattle reaches its maximum in Meerut, and steadily decreases as one goes eastward, until it becomes almost nil in Fatehpur and Allahabad. The value of a purchased animal is brought home more strongly to the cultivator than the value of a home-bred one, and much greater care is taken of the one than of the other. The western districts accordingly form the only tract in the Provinces where crops are grown on any large scale for cattle fodder. The large cultivation of juár as a green fodder crop in the Meerut Division has been already noticed. It occupies there more than ten times as large an area as in any other Division. The cultivation of guár also reaches its maximum in the same tract, and is an indication of the care of agricultural stock which one would be glad to see extended to other parts of the Provinces.

Season of sowing. Harvesting. Outturn.

Gúar is sown at the commencement of the rains and is cut in October. Its average produce of dry pulse to the acre may be taken as 10 maunds.

Explanation of Plate XXXV.

1. Upper part of plant, (nat. size.)
2. Flower with some of the petals removed, } slightly enlarged.
3. Flower, back view, }
4. Raceme of flowers and pods, }
5. A single pod, } nat. size.
6. Ditto with one valve removed, }

Drawn from a living specimen gathered at Sahárunpur.

ERUCA SATIVA, *Lam.**

[*Vide* Plate XXXVI.]

ENGLISH, none ; VERNACULAR, **duan, sahwan, tira, tara, taramira,** also **dua** and **chara** (Kumaun) ;† Sanscrit, **siddartha.**‡

Description. Natural order *Cruciferæ*, tribe *Brassiceæ*. An erect branching herb 3-4 ft. high. Stem solid terete, striate, hispid below with stiff reflexed hairs. Leaves dark green or glaucous ; lower ones 6-12 in. long, on long petioles, lobed or sub-entire ; upper deeply pinnatifid with the terminal lobe broadly ovate lyrate or oblanceolate ; petioles with a deep channel above, from the winged edges of which the leaf segments proceed. Inflorescence corymbose when young ; rachis somewhat flexuose. Pedicels about $\frac{1}{5}$ in. Calyx quadrangular, tubular, twice as long as the pedicels ; sepals erect or slightly divergent when in flower, lateral ones gibbous at the base. Petals 4, greenish yellow, with dark often purple veins. Stamens 6, tetradynamous. Pods closely adpressed to the stem, about 1 in. long, ovoid oblong, turgid, smooth, with a flat ensiform seedless beak half the length of the valves. Seeds numerous, in two series, oblong to sub-globose, compressed, light reddish brown.

Origin. A native of S. Europe and N. Africa.

The oil obtained from this plant is used for lighting purposes and for anointing the hair ; it is also consumed to a great extent as human food.

Distribution.

Mixtures. Its cultivation is most general in the western portions of the Provinces. It is most commonly grown mixed with gram or barley, or the combination of gram and barley known as *bejhar*, taking with these crops the place which rape fills in wheat fields. It is occasionally grown alone on land which has become too dry for the germination of any of the cold weather cereals, and it is very frequently sown in cotton fields, its seed being scattered over the ground before the cotton receives its first weeding, in which process they are buried.

Area. No returns are available of the area on which *dúan* is grown mixed with rabi crops, although it is known to be very large, especially in the western districts. Taking into account only the land on which it is grown by itself or in company with cotton, it is reported to occupy some 14,000 acres in the Meerut, 17,500 in the Agra, and 8,500 acres in the Rohilkhand Divisions. In the Allahabad Division it is only grown alone or with cotton on between 300 to 400 acres, and in the Jhansi and Benares Divisions its cultivation seems to be almost unknown.

Season. Duan may be sown at any time between the beginning of September to the end of November, and ripens about the same time as the rabi cereal harvest commences. The oil is pressed out in the ordinary oil mill, a *kolhu*, (*see til*, page 35,) by the professional oil presser (*teli*), who returns to the cultivator in oil from one-fourth to one-

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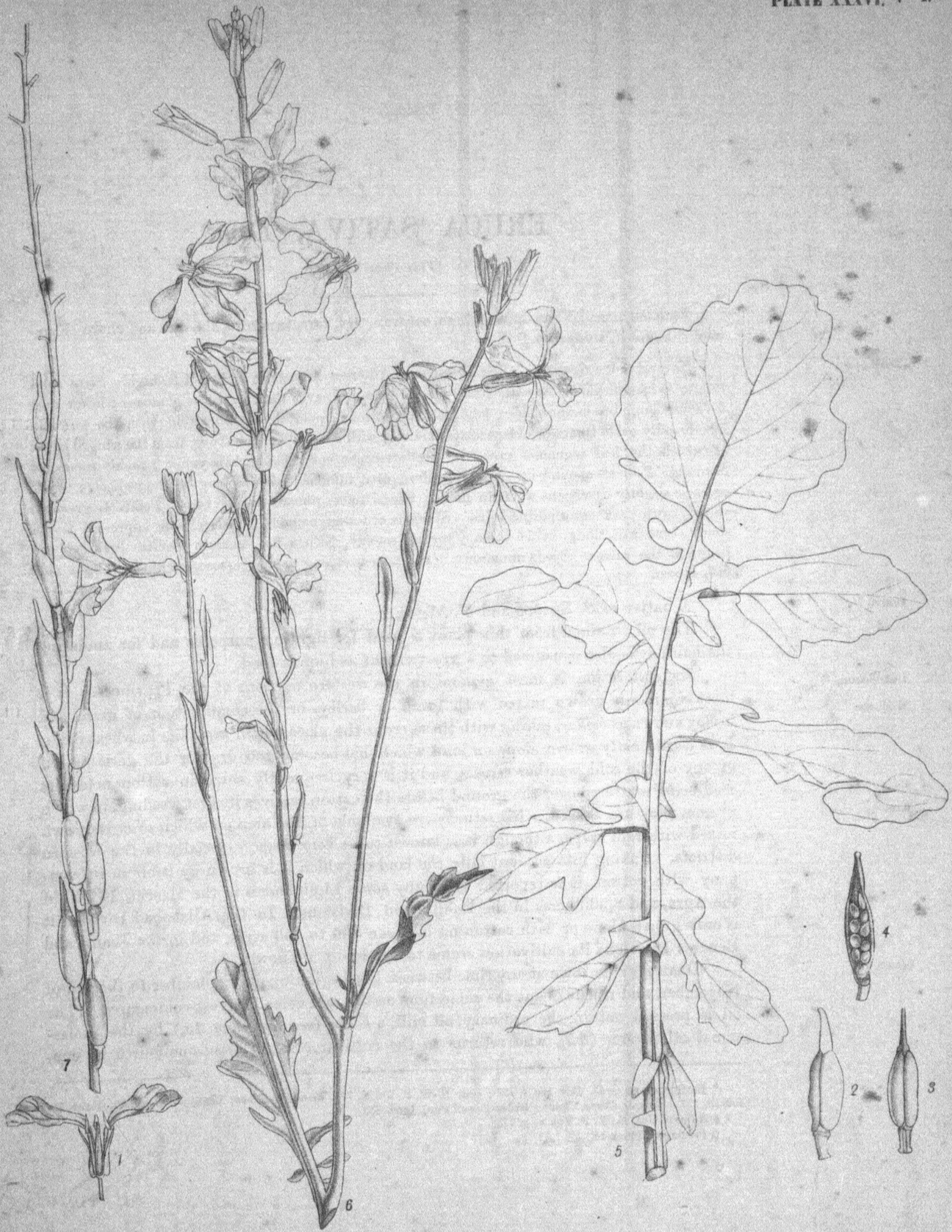
* **References** :—Fl. Brit. Ind. i. 158 ; Gaz. N.-W. P. Vol. x. 771. *Brassica Eruca*, Linn. *B. erucoides*, Roxb. Fl. Ind. iii. 117. *Sinapis Eruca*, Clairv ; Baden-Powell Punj. Prod. 419.

† Atkinson Gaz. N.-W. P. Vol. x. p. 771.

‡ Piddington Index 14.



ERUCA SATIVA, LAM.

Drawn by H. Heramsji

Litho. T. C. Press, Beerkoo.
Thos. D. Bona, *Superl.*

third of the weight of seed received. When grown alone or with cotton its produce of seed per acre varies from 4 to 12 maunds.

If cattle fodder runs short in February, dûan is not unfrequently cut green and given to cattle in that state. No use is made of its dry leaves and stalks.

Explanation of Plate XXXVI.

1. Flower with two petals removed,
2. Pod,
3. Pod,
4. Pod, with one valve removed,

} all nat. size.

5. Leaf from lower part of plant,
6. Upper portion of plant with inflorescence,
7. Raceme of pods,

} all nat. size.

Drawn from a living specimen gathered at Saháranpur.

BRASSICA CAMPESTRIS, *Linn.*

SUB-SPECIES NAPUS, *Linn. (Sp.)**

(*Vide* Plates XXXVII—XLa.)

ENGLISH, **rape**; VERNACULAR, (see under each variety.)

Description. Natural order *Cruciferæ*, tribe *Brassiceæ*. An erect glaucous annual 2-4 ft. high, smooth or the lower parts hispid. Root fusiform. Leaves alternate, the lower ones large, pinnatifid or lyrate, upper auricled. Flowers in corymbs, bright yellow; sepals 4, the two lateral ones saccate at the base. Petals 4. Stamens tetradynamous. Pods thick, 2-3-4 valved, or more slender and somewhat torulose. Seeds smooth or minutely rugose, yellow dark brown or reddish brown.

Var. GLAUCA.†

(*Vide* Plate XXXVII).

ENGLISH, none; VERNACULAR, **sarson, sarson zard, banga sarson** (Meerut, Dehra Dún, &c.) **pila sarson** (Oudh and Rohilkhand), **rara, rada** and **rara-sarson** (Kumaun),‡ **shwet rai** (Beng.)§ Sanscrit, **rajika**.‖

Description. Smooth and glaucous. Leaves amplexicaul, lower usually deeply pinnatifid and with the lobes coarsely dentate or scollop-toothed, corymbs contracted. Sepals sub-erect. Pods very thick, laterally compressed, with a broad flattened beak ⅓-½ their length. Seeds round, smooth, yellow or occasionally dark or reddish brown.

Var. TRILOCULARIS.¶

[*Vide* Plate XXXVIII].

ENGLISH, none; VERNACULAR, the same as given to *var. glauca.*

Description. Foliage dark glaucous. Lower leaves large, deeply pinnatifid and auricled, more or less rough with bristles; upper linear, entire, amplexicaul. Flowers pale yellow; sepals nearly erect. Pods 3-4 valved, curved, becoming pendulous as they ripen; beak ⅓-½ the length of the pod. Seeds yellow or brown.

The pendulous position of the pods is a striking distinction at first sight, but every

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* **References**:—Hook. Fl. Brit. Ind. i. 156.

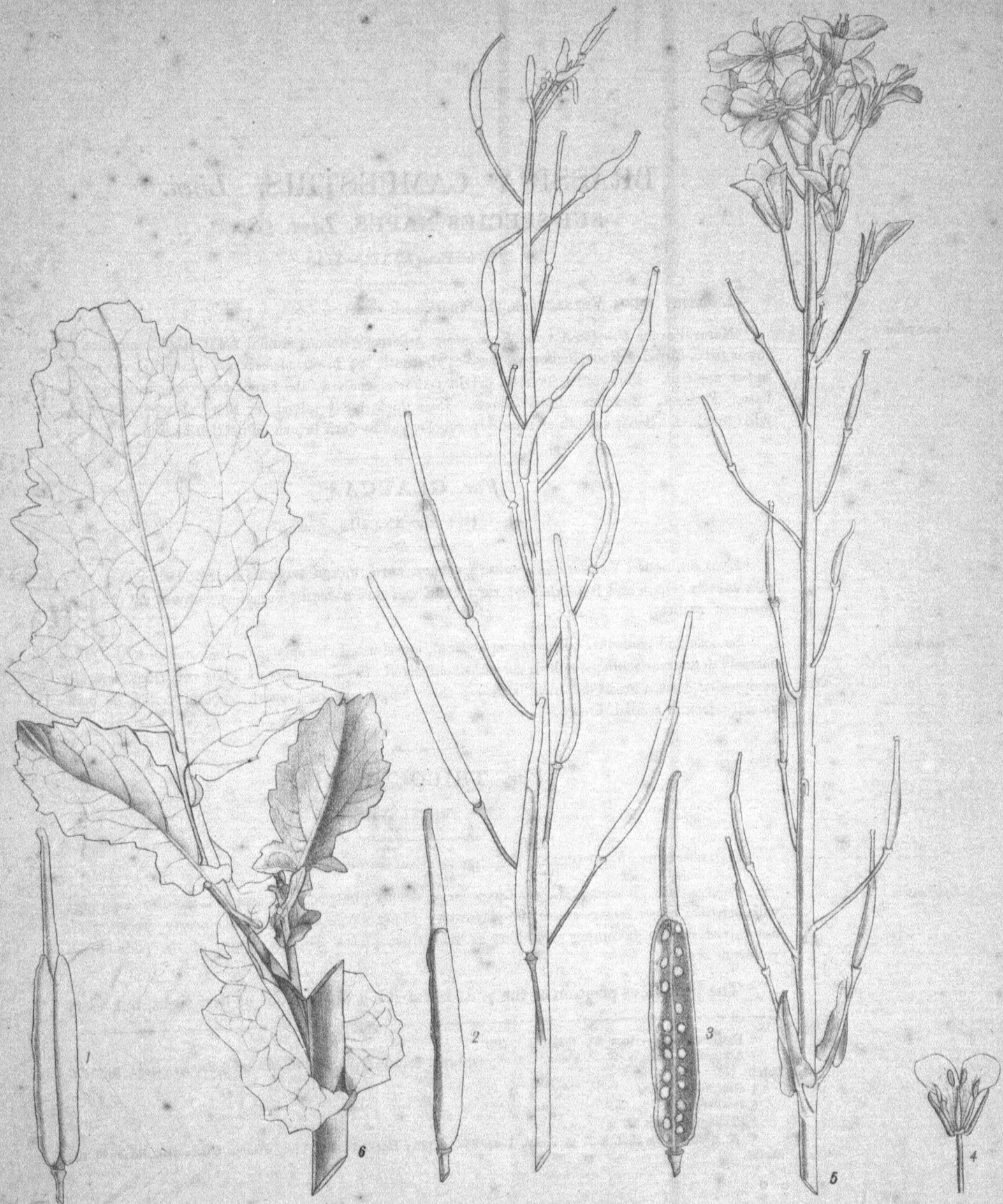
† Atkinson in Gaz. N.-W. P. Vol. x. 770. *B. campestris*, Linn. in Hook. Fl. Brit. Ind. l.c. *Sinapis glauca*, Roxb. Fl. Ind. iii. 118.

‡ Gaz. N.-W. P. l.c.

§ Roxburgh l.c.

‖ Piddington Index 82.

¶ *B. trilocularis*, H. f. & T. in Journ. Linn. Soc. v. 170; Hook. Fl. Ind. l.c. *Sinapis trilocularis*, Roxb. Fl. Ind. iii. 121.

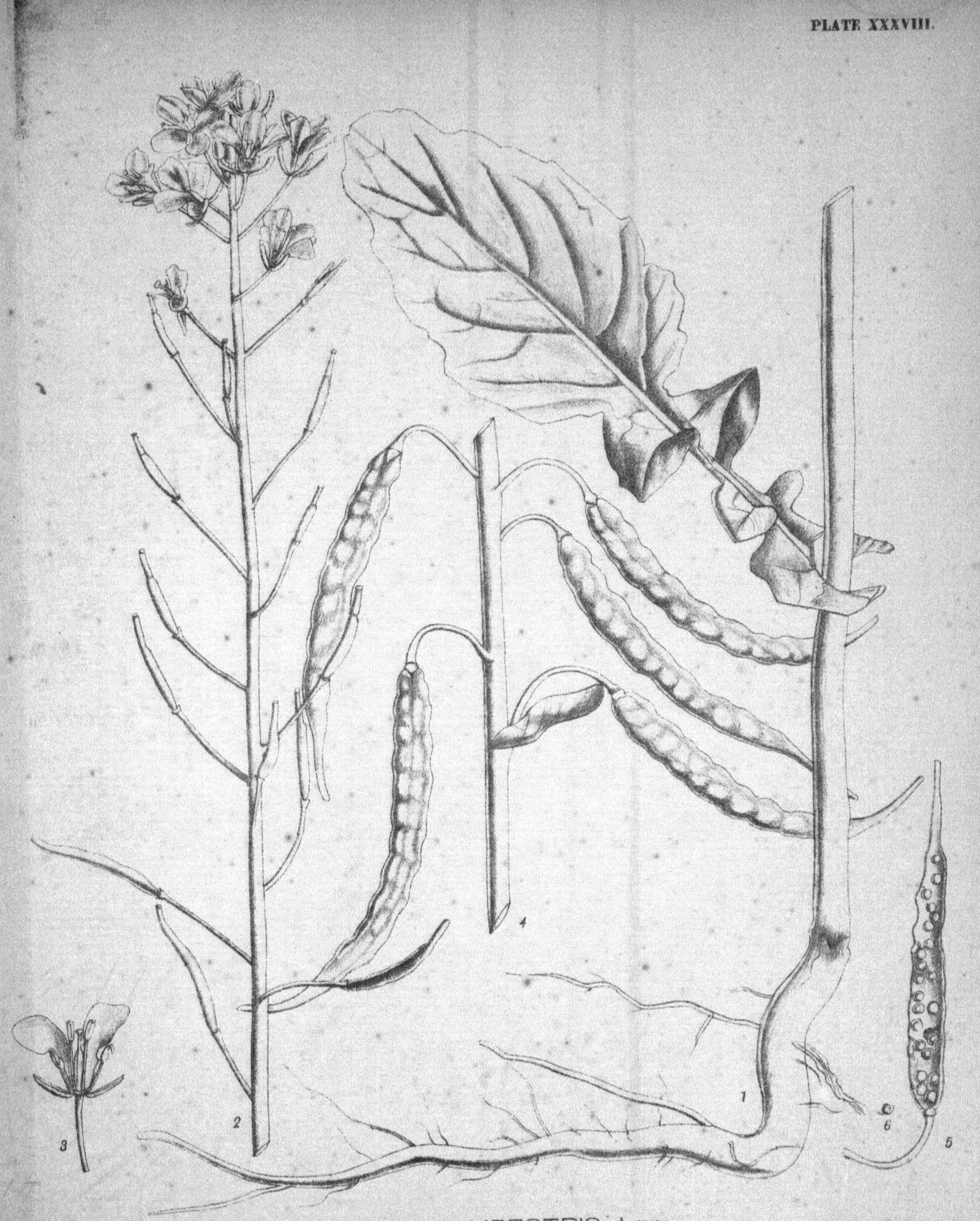


BRASSICA CAMPESTRIS, L.

(VAR. GLAUCA.)

Drawn by H. Hormusji.

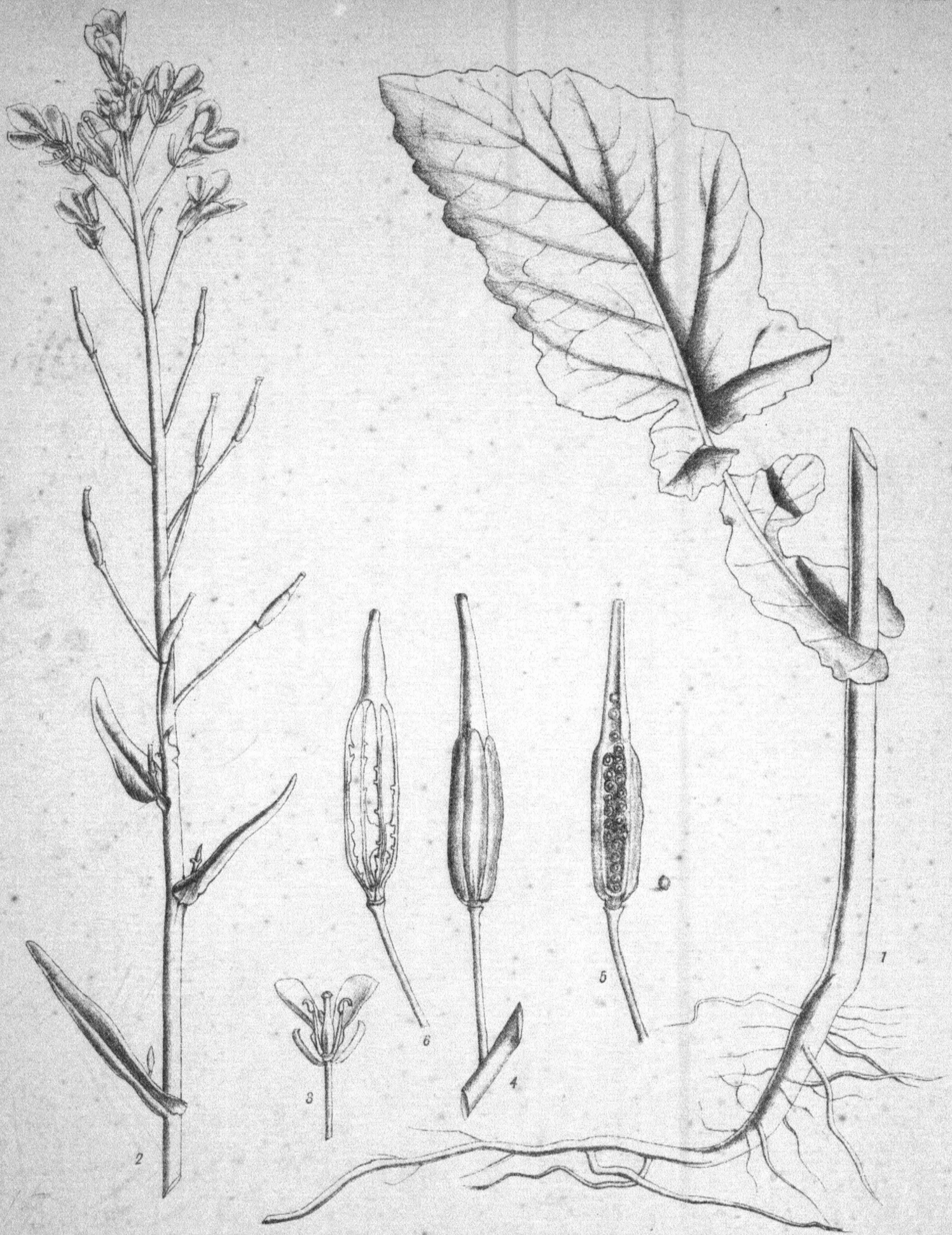
Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.



BRASSICA CAMPESTRIS, LINN.
VAR. TRILOCULARIS.

Drawn by H. Hormusji

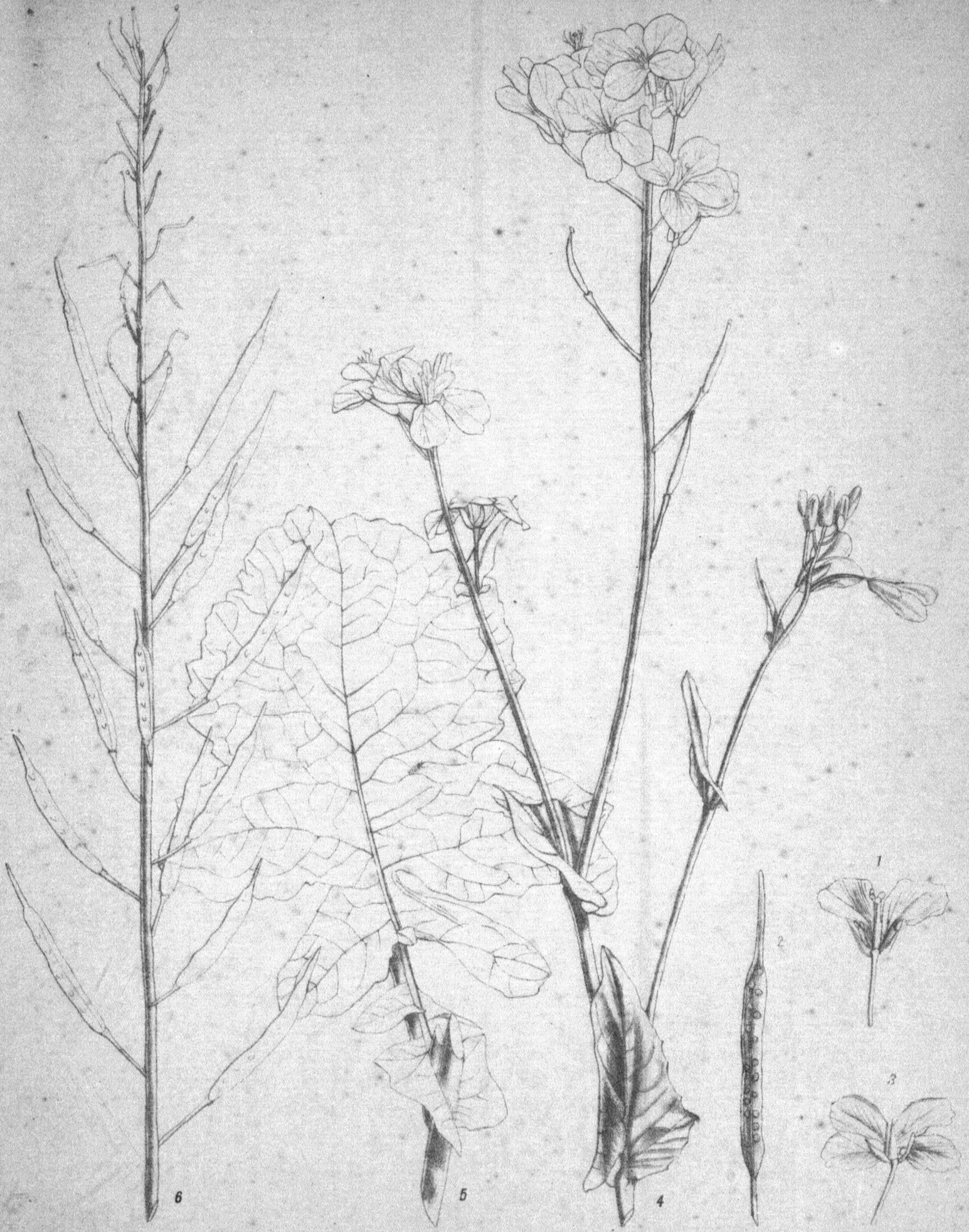
Litho T. C. Press, Roorkee.
Thos. D. Bona. Supdt.



BRASSICA CAMPESTRIS, LINN.
VAR. QUADRIVALVIS.

Drawn by H. Horsnell

Litho T. C. Press, Roorkee
Thos. D. Bona, Supdt.



BRASSICA CAMPESTRIS, L.

(VAR. DICHOTOMA.)

Drawn by H. Hormuzji

Litho T. C. Press, Roorkee.
Thos D, Rose, Sculpt.

Drawn by H. Hormusji

BRASSICA CAMPESTRIS, LINN.
VAR. TORIA.

Lithe T. C. Press, Roorkee.
Thos. D Bona, Supdt.

gradation from this state to the sub-erect position may be observed. When in flower this variety cannot be distinguished from flowering specimens of *B. glauca* and *B. quadrivalvis*. A specimen with pendulous pods raised from Lucknow seed bore 2-3-4-valved pods on the same plant.

Var. QUADRIVALVIS.*

[*Vide* Plate XXXIX.]

ENGLISH, none; VERNACULAR, same as given to *var. glauca*.

Description. Habit and foliage of *B. trilocularis*, but pods shorter on sub-erect pedicels, 4-valved, but usually only 1-celled owing to the absorption or non-development of the placental membrane. Seeds yellow or brown.

Var. DICHOTOMA.†

[*Vide* Plate XL.]

ENGLISH, none; VERNACULAR, **kâli sarson, lahsta** and **laita** (Bhabar)‡; **jariya** and **jadiya** (hills)§; **sanchi, shurshi, sada rayee** (Beng.)‖; Sanscrit **surshupa.**¶

Description. Glaucous, 4-6 ft. high, quite smooth except at the base of the stems and the lower leaves which are more or less bristly. Lower leaves about 1 ft. long, auricled, deeply pinnatifid, terminal segment large, sub-triangular or rounded, sinuate; petioles deeply channelled above; upper leaves lyrate or entire, with a cordate amplexicaul base. Panicles elongate; pedicels spreading, or becoming sub-erect as the pods ripen. Flowers numerous, deep yellow. Sepal sub-erect. Pods sub-cylindrical, 2-3 in., with a long tapering beak. Seeds dark brown, smooth or minutely rugose.

Var. TORIA.**

[*Vide* Plate XLa.]

ENGLISH none; VERNACULAR, **tori, toriya, khetiya,** also **dain, dáin** and **lai** (Kumaun and Garhwal)††; Sanscrit, **tuverica.**‡‡

Description. Whole plant quite smooth and glaucous, 2-3 ft. high. Lower leaves lyrate or pinnatifid, terminal lobe large, sub-triangular, obovate, sinuate; upper leaves amplexicaul, lanceolate, entire. Pedicels slender, ascending. Flowers bright yellow; sepals spreading. Pods 1½-1¾ in., rather slender, transversely compressed, more or less torulose; beak about ¼ in., slender, pointed. Seeds small, roundish or sub-compressed, reddish brown, finely rugose. A much shorter plant than the

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* **References**:—*B. quadrivalvis*, H. f. & T. in Journ. Linn. Soc. v. 169; Hook. Fl. Brit. Ind. i. 156.
† Gaz. N.-W. P. Vol. x. 770; *S. dichotoma*, Roxb. Fl. Ind. iii. 117; Royle Ill. 70.
‡ Gaz. N.-W. P. l.c.
§ Idem.
‖ Roxburgh l.c.
¶ Piddington Index 81.
** *B. glauca*, Royle in Gaz. N.-W. P. l.c.; Baden-Powell Punj. Prod. 419.
†† Atkinson in Gaz. l.c.
‡‡ Piddington Index 82.

preceding ; the pods too are shorter and somewhat torulose like those of *B. juncea*, and the seeds are of a lighter colour.

The liability to form hybrids is very marked in the family of plants to which the cabbage, the turnip and the mustard belong, especially under the influence of cultivation. It is not surprising, therefore, to find such results apparent amongst the different kinds of rape and mustard which are so largely grown in this country, considering also the great number of years they have been under cultivation.

The examination of nearly two hundred samples of *sarson, toria, lahi, rai,* &c., raised in the Saháranpur garden from seed received from nearly every district of the N.-W. Provinces and Oudh, has been the means of bringing under our observation a large number of intermediate forms ranging throughout an entire series from *Brassica campestris* to *B. juncea* and *chinensis*, including some well marked varieties which have by many authors been recognized as distinct species.*

The following analysis shows the main distinguishing characters of these varieties :—

Foliage usually glaucous and smooth, rarely hispid; leaves amplexicaul, auricled; seeds yellow or brown.
- Corymbs few-flowered; sepals erect; pods very thick, not torulose, 2-3-4-valved; seeds large, yellow or brown.
  - Pods erect, 2-valved *(B. glauca)*.
  - Pods pendulous, 3-4-valved *(B. tribocularis)*.
  - Pods erect, 4-valved *(B. quadrivalis)*.
- Corymbs many-flowered; sepals spreading; pods stoutish, somewhat torulose; seeds brown or reddish brown, rather large, minutely rugose.
  - Pods not torulose, slender, with a long tapering beak; seeds dark brown (*B. dichotoma*).
  - Pods somewhat torulose, short, with a sharp beak; seeds reddish brown (*B. Toria*).

Foliage usually bright green and more or less hispid; leaves stalked or the upper ones sessile, not amplexicaul; pods thin, torulose, seeds small, dark brown or reddish brown, distinctly reticulated (*B. juncea* and *B. chinensis*).

From an agricultural point of view the varieties of *B. campestris* may be classed under two heads, one including all those known as sarson, and the other including the variety known as lahi or toria. These are distinguished very sharply in their method of cultivation. Sarson is very seldom grown alone, but is sown in greater or less quantity in nearly every field of wheat and barley. Indeed in the districts of the middle and lower Doáb, which are especially well fitted for its production, hardly a wheat field will be found in which sarson does not find a place, being sown either broadcast or in parallel lines running across the field. Lahi on the other hand is as a rule grown alone, and is

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* The seeds alluded to above were received in 1880 ; for these and several dried specimens I am indebted to Mr. F. N. Wright, who was at that time officiating as Director of Agriculture and Commerce in these Provinces. The seeds were sown in separate plots, each sample being ticketed with its vernacular name and the locality from which it was sent. The plants were in full flower during the month of January, and by the end of March the majority had ripened their seeds. A certain portion of the original seed of each sample was reserved in order to compare it with the produce of the plants from the same seed grown in this garden. The plants in the several plots were constantly examined during their different stages of growth, and notes were made (1), as to the character of the foliage whether smooth or bristly, and the tint whether glaucous or bright green ; (2), the time of flowering, together with the arrangement of the flowers and their tint whether pale or dark yellow ; (3), the shape and size of the pods, and the colour and markings of the testa of the seed. Flowering and fruiting specimens of each sample were pressed and mounted in order to facilitate classification and subsequent examination. Drawings were also made of the more marked forms of each variety. A set of herbarium specimens representing the more marked forms were sent to Dr. King, Director, Royal Botanical Gardens, Calcutta, who kindly favoured me with his opinion as to their affinities. I am also indebted to him for copies of Roxburgh's drawings of the varieties of Indian mustard.—(J. F. D.)

produced in greatest abundance in the districts which border on the Himalayan Tarai. It is very little grown in the districts of the Ganges-Jumna Doáb, where it generally occurs as a subordinate crop in vegetable gardens, mixed with carrots and amaranth (*rámdána*). It is in this case sown in September, six weeks or two months before the regular rabi sowings commence.*

Area.

Sarson being so rarely grown alone, no adequate returns of the area which it occupies can be obtained. Its cultivation is, however, known to be largest in the Doáb districts lying between Meerut to the west and Allahabad to the east. The cultivation of lahi is only of importance in the line of districts lying under the Himalayas. Thus Saháranpur returns 5,400 acres, Bijnor 2,500 acres, Moradabad 2,800 acres, Tarai 2,000 acres, Pilibhit 1,500 acres, Basti 9,000 acres, and Gorakhpur 11,000 acres. In no other temporarily settled districts of the N.-W. Provinces does its area exceed 600 acres.

Both sarson and lahi are grown for their oil, which under the name of *karwa tel*, or bitter oil, forms an important ingredient in Indian cookery. It is also used for lighting purposes.

Mixtures.

Sarson is sown with wheat and barley, and cut immediately after they are harvested. Lahi is sown somewhat earlier, and comes into market in February and March.

Outturn.

The average produce of sarson to the acre varies of course very greatly, but may be assumed to be from 1½ to 2 maunds. Lahi produces from 4 to 6 maunds, but is the sole return for cultivation; whereas sarson merely supplements the more valuable cereal crop.

The outturn of rape is extremely precarious, or otherwise it would be much more generally grown as a sole crop than it is, since area for area the value of a crop of sarson would be considerably greater than that of a crop of wheat. It is, however, peculiarly liable to the attacks of a species of blight, and in damp seasons every plant in a field is not uncommonly covered with tiny insects (aphides), which suck the sap from the flowering shoots and effectually prevent any seed from growing. Where holdings are large, as they are in the sub-Himalayan country, a cultivator can afford to risk the total loss of the crop on a part of his land, with the chance before him of handsome profits if the season is propitious. But in the crowded districts of the Doáb the total loss of a crop means such distress to the cultivator that he prefers to make a certainty of a moderate profit than run any risk in aiming at a larger one. The cultivation of rape as a sole crop in some parts of the Provinces, and as a subordinate crop in other parts, is therefore explained by a difference in the density of population.

Injuries and diseases.

Rape oil is expressed after the ordinary fashion by the oil presser or *teli*, who returns to the cultivator one-third of the weight of the seed in oil. The export of rape is one

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* The *rara* variety (sarson) is grown all over the hills in small quantities only, as it requires much manure, and is liable to injury from hail. It is sown in first class unirrigated land in November-December and gathered in April. It yields about 3 maunds of oil to an acre. The *jariya* variety (*B. dichotoma*) is sown in the beginning of September, in fields where manure has been lying. The stalks are cut from the root, and when dry the grain is threshed out and the oil expressed in the common *kolhu*, or oil press. It is a favourite crop near Almora. The *lai* variety (*B. toria*) is cultivated all over the hills up to 11,000 feet, and is the staple mustard crop of the Bhábar (Atkinson in Gaz. N.-W. Prov.).

of the leading features in the commerce of the Provinces, and centres at Cawnpore, where in some years a very large and profitable business is carried on. The trade is, however, liable to great fluctuations, as is indicated by the following figures:—

Statement showing Railway Traffic in Rape seed.

	1879-80.	1880-81.	1881-82.	1882-83.
	maunds.	maunds.	maunds.	maunds.
To Calcutta, ...	12,52,340	1,87,169	11,75,463	21,66,773
„ other places, ...	5,10,631	86,979	6,13,882	6,15,778
Total gross Exports, ...	17,62,971	2,74,148	17,89,345	27,82,551
„ „ Imports, ...	28,429	68,448	14,958	5,988
Net Export, ...	17,34,542	2,05,700	17,74,387	27,76,563

Rape is not uncommonly cut green and given to cattle if cattle fodder runs short in January and February.

Explanation of Plate XXXVII.

1. } Full grown pods,
2. }
3. Vertical section of pods, } all nat. size.

4. Flower, vertical section,
5. Inflorescence, } all nat. size.
6. Lower leaf,

Explanation of Plate XXXVIII.

1. Lower portion of plant with root, } nat. size.
2. Inflorescence,
3. Flower with three of the petals removed, (slightly enlarged.)
4. Mature pendulous pods,
5. Vertical section of pod, } nat. size.
6. Seed,

Explanation of Plate XXXIX.

1. }
2. } As in preceding Plate.
3. }

4. Ripe pod,
5. Ditto with one valve removed, } nat. size.
6. Ditto with all the valves removed,

Explanation of Plate XL.

1. Flower with two petals removed,
2. Pod with one valve removed, } all nat. size.
3. Under side of flower,

4. Inflorescence,
5. Leaf from lower part of plant, } all nat. size.
6. Raceme of pods.

Explanation of Plate XLA.

1. Lower portion of stem with root,
2. Upper portion of stem with inflorescence, } all nat. size.
3. Flower, vertical section,

4. Ripe pod,
5. Ditto with one valve removed, } all nat. size.
6. Seed,

The above Plates are from Drawings of specimens cultivated in the Saháranpur Garden.

BRASSICA JUNCEA, HF. & T

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

BRASSICA JUNCEA, *H. f. & T.**

[*Vide* Plate XLI.]

ENGLISH, none; VERNACULAR, **rai, sarson rai,** also **lahi,** and **sarson lahi, gohna sarson** (Lucknow), **bari rai, barlái bádshahi-lai, shahzada rai,** and **khas rai** (Kumaun); Sanscrit **rajika.**†

Description.

Natural order *Cruciferæ*, tribe *Brassiceæ*. A tall erect annual 3-5 ft. in height with bright green foliage, rarely glaucous, more or less hispid towards the base. Stems much branched, smooth, terete, often tinged purplish red especially at the joints. Leaves not amplexicaul, the lower ones stalked, lyrate or pinnatifid, margin variously serrate dentate, often very hispid especially when young; petioles channelled, upper leaves sub-sessile, linear lanceolate, smooth, dentate or the uppermost quite entire. Racemes terminal; flowers stalked; pedicles elongating in fruit, divaricate. Calyx with linear boat-shaped spreading sepals. Petals small, bright yellow. Pods slender, 1-2 in. long, sub-compressed, torulose; beak about $\frac{1}{3}$ the length of the pod; valves with a prominent mid-rib. Seeds small, sub-globose, dark or reddish brown, with a rough reticulated testa.

Varieties.

This species varies very much in height, some of the kinds attaining 5 feet or more. It also varies in the shape of the pod; usually slender and nearly cylindrical, it sometimes becomes stout, laterally compressed, and less torulose than in the typical kinds, whilst the distinctive characters of the foliage and seeds remain the same. In other examples I have found the testa of the seed very indistinctly reticulate. The above abnormal variations would seem to characterize such forms of *B. juncea* as being intermediate between this species and the varieties *dichotoma* and *Toria* of *B. campestris*. Mr. Atkinson observes‡ that Roxburgh's *S. ramosa* is the "barlai" of Kumaun, and his *S. rugosa* is the "bádshahi-lai" or "bhotiya-lai" introduced by the Gorkhális from Nepal.

Mixtures.

Mustard is rarely grown alone, but is a common subordinate crop in fields of wheat, barley and peas. Its cultivation in this manner is not, however, nearly as extensive as that of rape, and it is more generally restricted to the borders of fields than broadcasted or sown in parallel lines across it.

In the districts of the Benares Division it is not uncommonly grown on a larger scale, being broadcasted in fields of peas. The mustard is sown first at the rate of about 3 lbs. to the acre, and the peas are put into the ground after it. When grown in this manner its outturn is from three to four maunds of seed to the acre.

Yield of oil.

Mustard seed yields less oil than rape-seed, the weight of oil being one-fourth instead of one-third of the weight of seed. The oil is used for the same purposes as that of rape, but is less esteemed as an article of food. The seed is very generally used

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* **References**:—Gaz. N.-W. P., Vol. x. 770. *S. Willdenovii*, Boiss. *Sinapis juncea*, Linn.; Boiss. Fl. Or. i. 394. *S. integrifolia*, Willd. *S. ramosa, rugosa, cuneifolia*, Roxb. Fl. Ind. iii. 119-124.

† Piddington Index 82.

‡ Gaz. N.-W. P. l. c.

as a spice to give flavour to vegetables, but sometimes as a medicine. In Kumaun, according to Mr. Atkinson,* it is cultivated chiefly for its leaves, which are eaten as a vegetable, cooked and dressed with spices and clarified butter.

Mustard, like rape, is not uncommonly cut green in January and February, and given to cattle should the supply of cattle fodder have run short.

In addition to the oil-yielding Brassicas which have already been described, there are three distinct species which are occasionally met with as cultivated plants in these Provinces, viz., *B. nigra*, Koch, *B. alba*, *H. f.* and *T.*, and *B. chinensis*, Linn. (*Sinapis*).

B. nigra† is the black mustard of commerce, the powdered seeds of which form one of the ingredients of ordinary table mustard. It is sparingly cultivated in these Provinces. It is used medicinally as a rubefacient and vesicant, and probably also as a condiment like rai (*B. juncea*). Samples of seeds were received from the following districts:—Agra (rai), Awa (makra rai), Bareilly (rai), Benares (Benarsi rai), Budaun (rai), Bulandshahr (lahi), Ghazipur (ghor rai), Hamirpur (Benarsi), Kumaun (rai), Meerut (rai), Mirzapur (jagrai sarson), Saháranpur (rai). The plant is easily distinguished by its compact corymbs of small bright yellow flowers, and the short slender pods adpressed to the stem.

B. alba‡ is the white mustard of commerce. It is used in this country for the same purposes as the preceding. Plants were raised in the Saháranpur garden from seed sent from the Kumaun Tarai, the only district from which it was received. It may be at once recognized by the large pale yellow flowers, and the spreading hispid pods with the large flat beak.

B. chinensis§ is a handsome tall growing plant with the habit and many of the characters of *B. juncea*. It has been cultivated in the Saháranpur garden for several years; seeds of this species have lately been received from Kumaun under the names of "China rai," "bádshahi rai," and "rai mustard."

Explanation of Plate XLI.

1. Flower seen from beneath,
2. Ditto, side view,

} slightly enlarged.

3. Single pod,
4. Upper portion of plant,
5. Lower leaf,
6. Inflorescence,

} nat. size.

Drawn from a living specimen gathered at Saháranpur.

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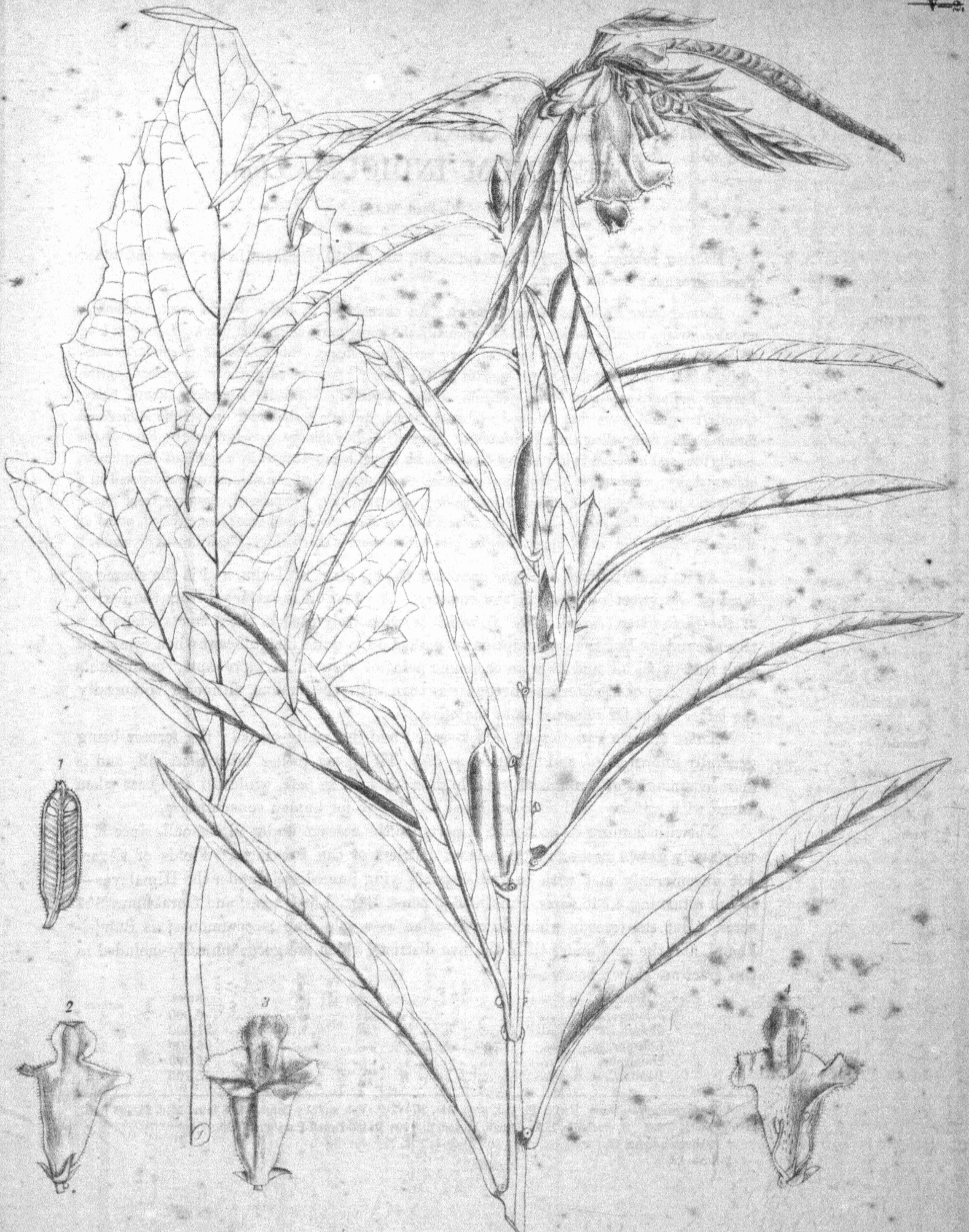
* References:—Gaz. N.-W. P. l. c.

† Hook. Fl. Brit. Ind. i. 156; Bentley and Trim. Med. Pl. 22; Gaz. N.-W. P. x. 729 and 769. *S. nigra*, Linn. *S. erysimoides*. Roxb. Fl Ind. iii. 123.

‡ Hook. Fl. Brit. Ind. i. 157; Bentley and Trim. Med. Pl. 23. *Sinapis alba*, Linn.

§ *Sinapis chinensis*, Linn.



SESAMUM INDICUM LINN.

Drawn by H. Hermansji

Litho T. C. Press, Roorkee.
Thos D. Dunn, *Supdt.*

SESAMUM INDICUM, *Linn.**

[*Vide* Plate XLII.]

ENGLISH, sesame, gingelly; VERNACULAR, til, tili, gingili (Southern India); Sanscrit, tila;† Persian, roghen; Arabic, duhn.‡

Description.

Natural order *Pedalineæ*, tribe *Sesameæ*. An annual 2-4 ft. high. Stems erect, branching angular, striate, usually thickly clothed, especially the upper parts with short hairs. Leaves on long stalks alternate or sub-opposite, crowded, very variable in shape, ovate lanceolate, tripartite or variously lobed, cuneate rounded or cordate at the base; upper usually linear lanceolate, entire. Flowers solitary, erect, on short pedicels. Calyx 5-parted; segments lanceolat, acute, hairy. Corolla irregular, somewhat 2-lipped; lobes 5, broad, spreading, the lower one a little longer and forming a lip, pale yellow tinged with pink. Stamens 4, didynamous, attached to the base of the corolla tube and included in it. Ovary 4-celled, each carpel being divided by a spurious dissepiment, oblong, hairy, surrounded at the base by a small fleshy disc. Ovules axile, many superposed in a single row in each cell. Capsule 1-2 in., oblong, quadrangular, compressed, opening from above loculicidally into two valves through the false dissepiments. Seeds numerous, compressed, ovoid or obliquely oblong, lower and upper margins girt with a slender sharp ridge, black brown or white.

As its name implies *til* is *par excellence* the oil plant of India, and is the source of most of the sweet oil used in the country. A sweet oil is extracted from the berries of the *mahua* tree (*Bassia latifolia*), which is extensively used in those tracts where this tree abounds. But the consumption of mahua oil is quite insignificant when compared with that of til oil, and from an economic point of view til is more aptly comparable with the olive of Mediterranean countries than with the mahua, although botanically the latter is not far removed from the olive.

Varieties.

There are two varieties, the black-seeded and the white-seeded; the former being generally known as *til*, and the latter as *tili*. Til ripens rather later than tili, and is more commonly grown mixed with high crops such as *juár*, while tili does best when mixed with cotton. Tili oil is preferred of the two for human consumption.

Area.

Notwithstanding its economic importance the acreage under til is small, since it is very rarely grown as a sole crop in most districts of the Provinces. Fields of til are not uncommonly met with in the districts lying immediately under the Himalayas—Dehra returning 3,536 acres, Pilibhit 616 acres, Basti 1,301 acres, and Gorakhpur 857 acres. But the tract in which its cultivation as a sole crop is commonest is Bundelkhand, and the area under til in the five districts which are geographically included in this tract are shown below:—

Districts.	Acres.
Jalaun, ...	6,000
Jhansi, ...	21,400
Lalitpur, ...	36,000
Hamirpur, ...	49,000
Banda,...	35,700

* References:—Drury Useful Pl. Ind. 389; Gaz. N.-W. P. Vol. x. 771; Bentley and Trim. Med. Pl. 198; DC. Orig. Pl. Cult. 337. *S. orientale*, Linn.; Roxb. Fl. Ind. iii. 100; Baden-Powell Punj. Prod. 420.

† Piddington Index 81.

‡ Roxb. l.c.

This amounts to no less than 8 per cent. of the total area under kharif crops in these five districts. The only other district in which til is largely grown alone is Allahabad (3,800 acres), and this is due to the fact that a large portion of the Allahabad district lies south of the Jumna, and is characterized by the same conditions as Bundelkhand. In no other district does its cultivation as a sole crop reach 300 acres. Judged by these returns til cultivation appears to be of insignificant importance over the greater part of the Provinces, but this is very far from being the case. Although not cultivated by itself, it is almost universally grown to a greater or less extent in fields of juár, bajrá and cotton, and it may be therefore said to have a place on more than half the total area under kharif crops. It is, however, grown less commonly in the eastern than in the western districts, both because it does not thrive in a rice country, and because the mahua tree (*Bassia latifolia*) abounds in the eastern districts, and mahua oil is commonly consumed there.

Season. As has already been implied, til is a kharif crop and is sown at the commencement of the monsoon, and harvested in October and November.

Soil. It prefers a light soil, and the wide extent of its cultivation in Bundelkhand is in great part limited to the light yellowish soil, locally known as *ránkar*, which abounds in the raviny tracts near rivers. Indeed a crop of til can be gathered from land which will yield no other crop but one of the inferior millets (kodon or kutki).

Method of cultivation. The method of its cultivation is the roughest possible. The seed is sown broadcast after two or three hurried ploughings and ploughed in. When grown with millet or cotton it gains the benefit of the care which these crops receive. It is in this case either sown broadcast, the seed being mixed with that of the principal crop before sowing, or it is disposed in parallel lines running across the field or along its margins. When mixed with other crops the amount of seed sown to the acre varies of course with the inclination of each individual cultivator. When grown alone from 8 to 12 seers of seed are used.

Harvesting. When ripe the til plants are cut with a sickle to within two or three inches of the ground, and the stalks collected in shocks, heads uppermost, and allowed to dry. The seed capsules split open and the seed is extracted by beating the plant against the ground. The dry stalks, called *tilsota*, are used for fuel.

Injuries. The til plant is very liable to damage from ill-timed rain, and this may explain the rarity of its cultivation as a sole crop in the thickly populated districts of the Ganges-Jumna Doáb, where risk must be reduced to the lowest minimum possible. Heavy rain, when the flowers are in process of fertilization, often ruins the crop, and hence, like bájra, it is very liable to suffer if rain falls in October. Indeed it is not uncommon for the crop to be an almost total failure.

Outturn. Under the circumstances of its cultivation it is obviously impossible to frame any reliable estimate of its outturn per acre, which varies very greatly with the amount of seed sown. From 25 seers to a maund-and-a-half are commonly gathered, when it is sown with juár or cotton. When grown alone from 4 to 6 maunds is the average return to the acre.

Mode of extracting the oil. The oil is extracted by simple pressure in a mill, which is identical in form with the *kolhu* or pestle-mill used for crushing sugar-cane, but of a smaller size. The mill

is worked by a single bullock, which has its eyes blind-folded to prevent, so it is said, giddiness. The animal is generally driven by a man or boy seated on the revolving beam, but a well trained bullock may often be seen patiently going its round without any one to look after it. Oil pressing is the peculiar occupation of a caste of men called *telis*, who are usually remunerated for the labour of pressing by receiving the oil cake and a wage of grain equal in weight to the oil expressed. The oil cake is used as cattle food, and in the western districts is much prized on this account, there being a considerable traffic in it. It is reported to be even occasionally used as human food by the poorer classes in times of distress.

Tili oil is not only eaten raw after the manner of other oil, but is also commonly used in the manufacture of sweetmeats and in the adulteration of *ghi*. It is occasionally used for lighting, and gives a clearer light than other vegetable oils, but burns more rapidly. Anointing the body is another use to which it is applied either in the crude state, or scented when it is termed *phalel*. The perfuming is effected by keeping the seeds between alternate layers of strong scented flowers, such as the *chambeli* (species of *Jasminum*) and *keora* (*Pandanus odoratissimus*). By this means the scent becomes communicated to the oilseed and fixed in the oil, which is subsequently pressed out in the ordinary manner. Good *phalel* commands as high a price as Rs. 160 per maund.

Explanation of Plate XLII.

1. Capsule, vertical section of (nat. size). | 2, 3, & 4. Different views of the flower (all nat. size).

Drawn from a living specimen gathered at Saháranpur.

RICINUS COMMUNIS, *Linn.**

[*Vide* Plate XLIII.]

ENGLISH, **castor-oil plant** (Palma Christi) ; VERNACULAR, **arend, rendi, reri, bhatreri; Sanscrit, eranda.**†

Description.

Natural order *Euphorbiaceæ*, tribe *Crotoneæ*. A smooth often glaucous annual or perennial, (in India usually a small tree.) Stems round, smooth, hollow. Petioles long, curved, with a more or less conspicuous stalked gland just below the blade, often a few sessile ones near their bases. Leaves alternate, peltate, glaucous or tinged with red, reddish and shining when young ; deeply 8-10-partite ; lobes ovate lanceolate, acuminate, unequally and coarsely serrate dentate, the serratures often tipped with glands. Stipules enclosing the buds large, ovate, yellowish, deciduous. Flowers paniculate, sub-terminal, monœcious ; male flowers on lower part of floral axis, shortly stalked, pedicles jointed near the middle ; female flowers nearly sessile and crowded at the upper part of the rachis. Bracts broadly triangular, soon withering. Perianth of male flower 3-5-parted ; segments triangular, ovate, acute, reflexed, valvate in æstivation. Stamens numerous, monadelphous, filaments branched, anther lobes distinct. Perianth segments of female flowers narrow lanceolate, erect, soon withering. Ovary superior, 3-celled, trigonous or sub-globose, shorter than the perianth, its blunt angles armed with soft spine-tipped finger-like prominences. Ovules pendulous, one in each cell ; styles 3, connate, each deeply divided into two linear branches, their inner faces bright crimson and papillose. Capsule about an inch long, tricoccous, splitting loculicidally and septicidally, external prominences persistent, sharp. Seeds about $\frac{5}{8}$-in. long, with a conspicuous caruncle at the hilum end, flattened, smooth, pinkish grey and beautifully mottled with dark brown ; cotyledons leaflike, broadly cordate, veined.

Origin.

According to M. Decandolle† this plant is a native of Tropical Africa, whence it has spread by commerce and cultivation to Asia and along the coasts of the Mediterranean.

The use to which castor oil is generally put in this country is that of lighting, but it is also largely used for lubricating the wearing parts of implements, such as cart axles, &c.

Varieties.

Two varieties are reported to be grown in the Azamgarh district, known respectively as *reri* and *bhatreri*. The former is the taller of the two, and is said to be invariably cut down after the first year, whilst bhatreri trees are allowed to remain for two or three years. The seeds of the bhatreri variety are reported to be richer in oil than those of the other variety.

Distribution.

Castor is grown to a greater or less extent in every district of the Provinces, but usually as a field border, and very rarely as a sole crop. The only division indeed in which the area it covers is large enough to deserve mention is Allahabad, where it is reported to be grown alone on between 1,200 and 1,300 acres, situated principally along the margin of the river Jumna. It is on the other hand a very common border-

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* **References** :—Roxb. Fl. Ind. iii. 689 ; Müll. Arg. in DC. Prod. xv. Part ii. 1016 ; Drury Useful Pl. of Ind. 365 ; Baden-Powell Punj. Prod. 421 ; Gaz. N.-W. P. Vol. x. 772 ; Bentley and Trim. Med. Pl. 237 ; DC. L'Orig. Pl. Cult. 339.

† Piddington Index 76.

‡ DC. L'Orig. Pl. Cult. l.c.

RICINUS COMMUNIS, L.

Drawn by H. Hormusji.

Litho T. C. Press, Roorkee.
Thos D. Bons. *Supdt.*

ing to cotton and sugar-cane fields, and is not uncommonly grown on isolated patches of a few square yards in the neighbourhood of dwelling houses, and used as a support for the creeping bean known as *sém* (*Dolichos lablab*). It thrives on a rich soil, but curiously enough succeeds exceedingly well when sown along the top of the high mud banks which commonly surround orchards and vegetable gardens. In this situation the young plants are protected from flooding, and their roots rapidly strike deep enough to acquire sufficient moisture.

Soil.

Season.

It is sown at the commencement of the monsoon or in the hot weather just before the rains break. The seeds are either sown behind the plough, being dropped at intervals of about 18 inches in every alternate furrow, or they are planted by hand. In the latter case a little manure is commonly buried with them. The young plants are occasionally earthed up to prevent the accumulation of water round the bottom of the stem. The seeds ripen in March and April.

Harvesting.

When ripe the seed pods are picked, and are either dried in the sun and broken by rolling (Azamgarh), or are buried in the ground and allowed to rot. The latter is the common practise in Doáb districts. The oil is extracted by boiling, and the operation is not performed by the professional oil pressers (or *telis*), but by the gram-parchers (*bhurjis*). The seeds are first slightly roasted, then crushed in a mortar, and then boiled in water over a quick fire, when the oil rises to the surface and is skimmed off. As a rule the seeds yield a quarter of their weight of oil, but seeds of the bhatreri variety are said to yield as much as one-third of their weight.

Method of extracting the oil.

Young castor leaves are relished by cattle, and the dried stalks are utilized for thatching. Castor trees are commonly cut down after their first year, but it has been already mentioned that the bhatreri variety of Azamgarh is commonly allowed to stand for three or four years, when it yields a crop of seed each spring, and is finally cut down, not because its bearing powers are exhausted, but because it is a breeding ground for a hairy brown caterpillar which is supposed to bring ill-luck.

Yield of seed.

A well grown castor plant will yield as much as 10 seers (= 20 lbs.) of seed in a season, but the plants which are grown round fields rarely give more than from ¾ seer to 1½ seer apiece. The yield of individual plants grown together as a single crop in a field is much less than this, since flowering is hindered by a loss of light and air, when the plants are not separated from each other by a considerable space.

The castor is popularily ranked as the *chamár* amongst plants, and men of this caste are particularly afraid of a blow from the stalk of a castor plant.

Explanation of Plate XLIII.

1. Upper portion of plant with inflorescence, } nat. size.
2. Male flower, } enlarged.
3. Ditto, seen from below, } enlarged.
4. Cluster of young capsules, } nat. size.
5. Single capsule, } nat. size.
6. A carpel opened to show the seed, } nat. size.
7 & 8. Seed, } nat. size.

Drawn from a living specimen gathered at Saháranpur.

LINUM USITATISSIMUM, *Linn.**

[*Vide* Plate XLIV.]

ENGLISH, flax, linseed; VERNACULAR, alsi, tisi; Sanscrit, úma, atasi, utasi.†

Description.

Natural order *Lineæ*, tribe *Eulineæ*. A smooth erect annual, 3-4 ft. high. Stems terete, woody at the base, usually simple below, corymbosely branched above; stipules none. Leaves about 1 in. long, narrow lanceolate, entire, 3-nerved. Flowers arranged in broad corymbose cymes; pedicles 1-1¼ in. long, slender, erect. Sepals 5, ovate, acuminate, 3-nerved, edged with a membranous ciliated margin. Petals 5, bright blue with darker coloured veins, rarely white, twice as long as the sepals, ovate with a cuneate base. Stamens 5, coherent below, alternating with minute gland-like staminodes. Styles free; stigmas linear, clavate. Ovary syncarpous; carpels 5, each divided into two locelli by spurious partitions from the placentas, axile margins ciliate; ovules 10, one in each locellus. Capsule sub-globose, a little longer than the sepals, acute at the apex. Seeds about ¼ in. long, compressed, ovoid; testa rich chestnut brown, rarely white, smooth and shining.

Origin.

M. Decandolle in his recently published work on Cultivated Plants observes that this plant is indigenous in certain localities situated between the Persian Gulf, the Caspian and the Black Seas. He traces the history of this plant and that of a perennial species named *L. angustifolium*, which latter appears to have been cultivated in very ancient times, and to have been replaced by *L. usitatissimum* within the last 4 or 5,000 years.

Flax is grown in India solely for its seed, and no use whatever is made of the fibre which its stems contain. The object of cultivation being to promote flowering and not stem growth, it is sown much thinner than it is in Europe, and the plant has developed a branching habit of growth which would greatly lessen the value of its fibre, even were it now carefully cultivated for that purpose. Numerous experiments have been made within the last 40 years in growing flax in India, and very considerable success was obtained by a Belgian flax grower in Tirhoot with seed which had been imported from Europe. But it is improbable that flax culture could be extended on any other system than that followed by indigo planters, under which the grower receives a cash advance at sowing time, together with a guarantee that his crop will be purchased at a fixed price. Flax fibre would be useless to a cultivator unless he was certain of gaining a sale for it. It does not seem that any energetic attempts have been made to extend flax culture on this system, and what efforts have been made to promote it have been confined to experiments which have indeed proved the possibility of successful flax growing, but have given native cultivators no immediate incentive to undertaking it.

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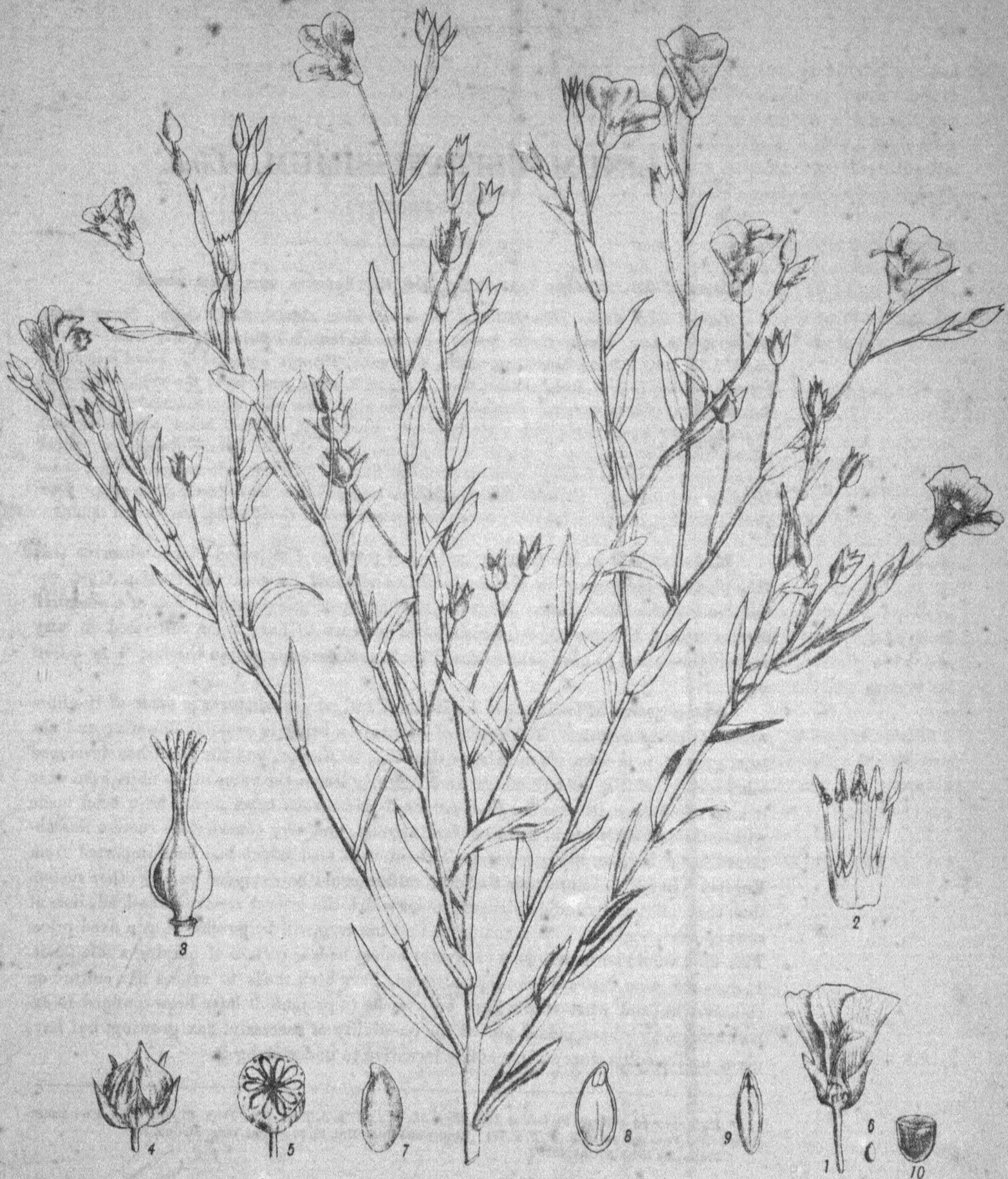
* References:—Roxb. Fl. Ind. ii. 110; Royle Ill. 82; W. & A. Prod. 134; Hook. Fl. Brit. Ind. i. 410; Baden-Powell Punj. Prod. 38; Gaz. N.-W. P. x. 771; Bentley and Trim. Med. Pl. 39; DC. L'Orig. Pl. Cult. 95.

† Piddington Index; Roxb. l.c.



LINUM USITATISSIMUM, LINN.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.
Thos. D. Bona, *Supdt.*

Varieties.

The colour of the flowers varies from a beautiful sky blue to pure white. The colour of the seeds is generally a rich brown, but a white-seeded variety is known in the south of Bundelkhand and in some parts of Central India. The oil of this variety is in many respects more valuable than that of ordinary linseed, especially for colour-mixing, and the so-called "white" linseed has attracted considerable attention. Its cultivation is, however, insignificant.

Distribution.

Soils.

The distribution of linseed cultivation offers an interesting contrast to that of *til*. In both cases Bundelkhand is an important field of production, but for very different reasons. *Til* is grown on the light raviny lands which lie along courses of rivers and drainage lines, while linseed is grown on the heavy black *már* or cotton soil of which the level plains are formed. *Til* in fact prefers a light, and linseed a heavy, clay soil, and hence linseed is very largely grown in the eastern rice-growing districts, where *til* cultivation reaches its minimum. Linseed is also grown to a considerable extent in the sub-Himalayan districts. Like *til* it is hardly ever cultivated as a sole crop in the districts of the Ganges-Jumna Doáb, but unlike *til* its cultivation in this tract is confined to an occasional bordering to wheat or gram fields, and its production as a subordinate crop in a mixture is quite insignificant.

Area.

Linseed cultivation thus is of insignificant importance in the Meerut Division and still more so in the Agra Division. In the Rohilkhand Division it is returned as occupying between 12,000 and 13,000 acres. In the Jhansi Division, which forms the western and least fertile portion of Bundelkhand, it occupies about 5,000 acres, while in eastern Bundelkhand, comprising the Hamirpur, Banda and part of the Allahabad District, its area reaches 49,000 acres, or 4 per cent. of the total area under rabi crops. But its cultivation reaches its maximum in the Benares Division. The three districts of Azamgarh, Basti, and Gorakhpur return no less than 1,22,000 acres under linseed, which amounts to 6 per cent. on their total area cropped in the rabi season.

Method of cultivation.

Its method of cultivation varies very greatly in different localities. In the districts of the Ganges-Jumna Doáb it is as a rule merely sown in a line round the border of a wheat or barley field, or is grown in parallel lines across a field of gram. In Bundelkhand it is grown either alone or mixed in large quantities with gram, and in both cases the ground receives three or four ploughings during the rains preceding. The seed is sown broadcast at the rate of 8 to 12 seers to the acre. In the Benares Division it is largely grown on land which is under water during the rains, and in this case its cultivation is of the roughest possible description, no preparatory ploughings being given, but the seed simply scattered over the ground and ploughed in. It is very commonly grown in this fashion in rice fields, the rice stubble being left standing.

Irrigation.

Linseed is very rarely irrigated when grown by itself, except in the Basti and Gorakhpur Districts, where a quarter of the total linseed area is returned as receiving one or two waterings.

Harvesting.

The plants are cut down when ripe, and the seeds extracted from the capsules by beating.

Average outturn.

The average produce of linseed in Bundelkhand is from 6 to 8 maunds per acre. In Basti and Gorakhpur it may be put as considerably more than this, 10 maunds being probably not an excessive estimate.

Statement showing the Railway Traffic in Linseed for the last four years.

	1879-80.	1880-81.	1881-82.	1882-83.
	maunds.	maunds.	maunds.	maunds.
To Calcutta, ...	2,36,633	6,75,553	4,21,865	6,93,814
„ other places, ...	24,601	91,482	78,399	23,463
Total Gross Exports, ...	2,61,234	7,67,035	5,00,264	7,17,277
„ Imports, ...	305	1,184	104	652
Net Exports, ...	2,60,929	7,65,851	5,00,160	7,16,625

Yield of oil.

The seed yields one-fourth of its weight of oil. The oil is extracted by pressure in the same description of mill or *kolhu*, which is used in expressing *til* oil. The oil presser or *teli*, is usually remunerated for his trouble by receiving the oil cake, which is a very valuable food for cattle, and is also occasionally eaten as human food under the name of *pinna*. Linseed itself is sometimes used as human food, being bruised in a mortar and baked in dough.

Explanation of Plate XLIV.

1. Flower, vertical section of,
2. Androecium,
3. Gynoecium,

} enlarged.

4. Capsule,
5. Ditto, transverse section,
6. Seed,

} nat. size.

7. Seed.
8. Ditto, vertical section,
9. Ditto, back view,
10. Ditto, vertical section,

} enlarged.

Drawn from a living specimen gathered at Sahâranpur.

BENINCASA CERIFERA, Savi.

Drawn by H. Hormuzji

Litho. T. J. Press, Roorkee.
Thos. D. Bona, Supdt.

BENINCASA CERIFERA, *Savi.**

[*Vide* Plate XLV.]

ENGLISH, **white gourd melon**; VERNACULAR, **petha** (Saháranpur), **kumhra** (Cawnpore), **kondha** (Allahabad), **bhunja** and **chal-kumhra** (Himalayan Districts).†

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. A large climbing or trailing gourd thickly clothed with white or rusty coloured pubescence. Stems thick, angular, sulcate, hispid, hairs jointed; tendrils usually 3-fid. Leaves 3-6 in. across, sub-orbicular, cordate, 5-7 lobed; lobes broadly triangular, acute or acuminate, bright green above, paler below and more hispid; petiole thick, 2-3 in. long, without glands at the apex. Flowers large, yellow, solitary, monœcious. Male:—calyx tube campanulate, densely villous, lobes 5, large, serrate; corolla deeply lobed, divisions nearly separate, obovate, mucronate; stamens 3, inserted near the mouth of the corolla tube, filaments angular, hispid at the base, anthers exserted, free, 1-celled in one and 2-celled in the other two, cells sigmoid. Female:—calyx and corolla as in male; ovary oblong or ovoid, hairy; style thick, stigmas 3, flexuose; ovules numerous, horizontal; fruit fleshy, oblong or ovoid cylindrical, 1-1½ ft., hairy and bright green when young, becoming smooth when ripe, and covered with a waxy bloom, often blotched with white, flesh white; seeds ovate oblong, about ⅝-in. long, flat, maringed.

Origin.

A native of Japan and Java according to M. Decandolle.‡

Varieties.

This plant has a superficial resemblance to the *pumpkin* (*Cucurbita Pepo*), under which name it was described by Roxburgh (l. c.); and even now the seeds of *kumhra* (*Benincasa*) are constantly distributed in this country under the name of *C. Pepo*. It may easily be distinguished from the latter however by its soft not pungent hairiness, and by the wax-like bloom which covers the fruit.

Cultivation.

The cultivation of this and the following species of gourds is restricted as a rule to little highly manured patches in the vicinity of the village sites, and is almost entirely in the hands of men of the *káchi* and *máli* (or *murao*) castes. They may be sown either in the hot weather or at the commencement of the rains, and with the exception of melons, continue fruiting until the close of the rainy season.

Occasionally they form the sole crop on a field, but they are more generally associated with a number of other vegetables, whose habit of growth permits of their being grown together without much mutual harm. Thus gourds are not uncommonly sown in lines between rows of young sugar-cane or maize, being off the ground before the main crop has grown sufficiently high to choke them. Certain of the order (*e. g.*,

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* **References**:—Hook. Fl. Brit. Ind. ii. 616; Kurz. in Journ. As. Soc. Beng. (1877) Part ii. 101; Baden-Powell Punj. Prod. 265; Atkinson Econom. Prod. N.-W. P. Part v. p. 7; Gaz. N.-W. P. Vol. x. 700; 265. *B. hispida*, Cogniaux in DC. Mon. Phan. iii. 513; Rheede Hort. 8 p. 5 t. 3; DC. L'Orig. Pl. Cult. 213. *Cucurbita Pepo*, Lour. Fl. Cochin 503; Roxb. Fl. Ind. iii. 718; Gaz. N.-W. P. Vol. x. 702 (in part).

† Gaz. N.-W. P. Vol. x. l.c.

‡ Orig. Pl. Cult. l c.

the melons) are also very commonly grown on the deposits of sand and silt which are left exposed in the beds of rivers during the hot months.

Area

No complete returns of the area under *kumhra* are available. As an indication of the extent to which it is cultivated, it may be mentioned that it is reported to cover 114 acres in the Allahabad district.

The fruit is used as a vegetable, and forms also an ingredient in curries. In Saháranpur the fruit is largely used by the confectioners for the manufacture of a sweetmeat called *heshmi*, sold at 3 lbs. per rupee.

Explanation of Plate XLV.

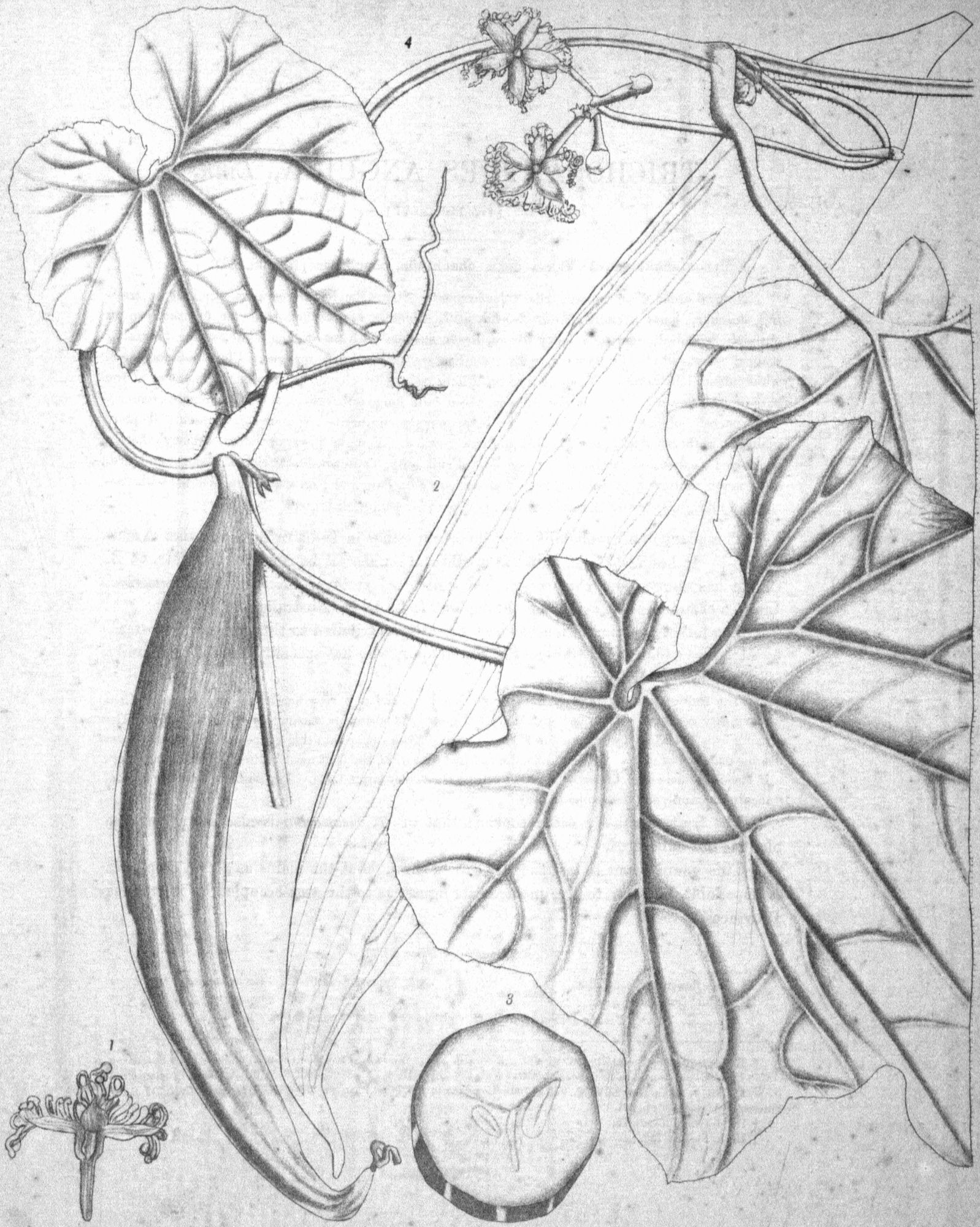
1. Mature fruit,
2. Transverse section of ditto,
3. Male flower, vertical section,

} all nat. size.

4. Female flower, vertical section,
5. Portion of branch,

} all nat. size.

From a drawing of a living specimen cultivated at Saháranpur.



TRICHOSANTHES ANGUINA, L.

Drawn by H. Hormuzji.

Litho. T. C. Press, Roorkee.
Thos. B. Bona, *Supdt.*

TRICHOSANTHES ANGUINA, *Linn.**

[*Vide* Plate XLVI.]

ENGLISH, **snake gourd**; VERNACULAR, **chachinda, chachinga** (Rohilkhand).

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Stems slender, herbaceous, climbing or trailing, angular, hairy; tendrils 3- or 2-5-fid, stiff, sulcate. Leaves sub-orbicular or reniform in outline, 5-7-lobed, sparingly hairy above, lower surface with short dense pubescence becoming scabrid when old; lobes rounded, with a denticulate and undulate margin. Flowers monœcious, white, about 1 in. across. Male flowers on a long peduncled raceme with minute bracteoles at the base of each flower; calyx slender, tubular, about 1 in. long, puberulous, teeth 5, subulate; corolla lobes narrow, oblong, free almost to the base, margins fimbriate; stamens 3, filaments slender, glabrous, anthers connate, one 1-celled and two 2-celled. Female flowers solitary, axillary, shortly pedunçled; calyx and corolla as in the male. Fruit long, fusiform, but variable in shape and size, often much contorted, greenish white. Seeds about $\frac{3}{4}$ in. long and $\frac{1}{2}$ in. wide, flat, oblong, with corrugated margin, truncate or retuse at the apex, grey or yellowish brown.

Origin.

This plant in all probability had its origin either in India or in the Indian Archipelago.† It has never been found in a wild state, unless it be considered, as Mr. C. B. Clarke has suggested,‡ to represent the cultivated state of *Trichosanthes cucumerina*, Linn., a common plant extending throughout India to N. Australia.

The following information has been recently contributed to the "Indian Forester" by Mr. W. Gollan, Head Gardener at Saháranpur, who has specially studied this family of plants under cultivation :—

"The fruit of this vegetable is from 1 to 3 feet long, and of a very handsome appearance. When "young they are beautifully striped with white and green, and when ripe change to a brilliant orange. The "young fruit is used as a substitute for French beans. When cut up into thin strips and boiled, they form "a fair imitation of that vegetable. Like the *káli* and *ghia turai*, the fruit must be used when very young. "If cut when more than 4 inches long they often have a very bitter taste. Two sowings should be made, "the first in April, and the second in May."

The fruit is usually eaten cooked; that of *T. cucumerina* is also eaten, but the plant is not cultivated.

This gourd seems to be generally grown throughout the plains as a rain crop. It is impossible, however, to give any accurate figures as to the area occupied by it in these Provinces.

Explanation of Plate XLVI.

1. Male flower, vertical section,
2. Mature fruit,

} nat. size.

3. Transverse section of ditto, (nat. size).

From a drawing of a living specimen cultivated at Saháranpur.

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* **References** :—Roxb. Fl. Ind. iii. 701; Royle Ill. 219; W. & A. Prod. 350; Kurz. in Journ. As. Soc. Beng. (1877) Part ii. 98; Naudin in Ann. Sc. Nat. Ser. 4 Vol. 18 p. 190; Hook. Fl. Brit. Ind. ii. 610; Atkinson Econom. Prod. N.-W. P. Part v. p. 4; Gaz. N.-W. P. Vol. x. 700; Cogniaux in DC. Mon. Phan. iii. 359; DC. L'Orig. Pl. Cult. 217; Ind. Forester Vol. ix. (1883) p. 201.

† DC. L'Orig. Pl. Cult. l.c.

‡ Hook. Fl. Brit. Ind. l.c.

CITRULLUS VULGARIS, *Schrad.*

Var. FISTULOSUS.*

[*Vide* Plate XLVII.]

ENGLISH none; VERNACULAR, **tendús** (Bijnor), **tendu** and **tensi** (Doáb), **tinda** (Punjab), **meho, trindus, dilpasand, tinda** and **alvinda** (Sindh).

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Stems diffuse, stout, fistulous. Young shoots densely villous with long soft spreading hairs intermixed with much glandular pubescence which disappears with age; tendrils 3-fid. Leaves green and shining above when young; old leaves scabrous; under surface paler, densely hairy on the nerves; petioles furrowed, fistulous; blade ovate cordate, 5-nerved, 5-lobed, sinuses extending to one-third or one-half towards the centre of the blade. Flowers monœcious, solitary. Male:—peduncle shorter than the petiole; calyx villous, the tube spread out nearly flat and crowned abruptly by the five short teeth; corolla flat, hairy outside; stamens as in *C. vulgaris;* disc filling up the base of the calyx between the stamens. Female:—flower on a thick peduncle which lengthens and curves downwards in fruit; calyx quite flat; corolla as in male; disc collar-shaped round the style; ovary sub-globose, softly villous; style very short, individed or rarely shortly 3-cleft at the apex; stigmas thick forming together a round head. Fruit about the size of a small turnip, of a light apple green colour, depressed at each end, hispid when young, at length becoming quite smooth. Seeds black, about ¾ in. long, marked on both sides by an elevated ridge which follows the outline of the seed.

Dr. Stocks, from whose paper in Hooker's Journal of Botany much of the above description has been taken, further adds:—

"As a species this is recognized at once from its congeners, the *colocynth* and the *water-melon* "(*C. Colocynthis* and *vulgaris*), which are the only others I have to compare, by its much less divided 5-"nerved and 5-lobed leaves, not glaucous as in the water-melon, or hoary as in the *colocynth*. Both these "last have 3-nerved, 3-lobed leaves, cleft almost to the midrib, with the divisions also deeply lobulated. The "tendrils in the *colocynth* are generally undivided or rarely bifid; in the *water-melon* they are bifid, but here "they are generally 3-4 rarely 5-cleft. The fistulous stem and petioles are an absolute distinction. The "calyx is here much more flat than in the other two, where it is campanulate at the base. The very short "style, the almost globose ovary, the depressed fruit of uniform colour, not striped or speckled in any stage "of its growth, are further marks of distinction. The seeds differ from the smooth thin seeds of the colo-"cynth, and resemble more those of the *water-melon*. Finally, the poisonous *colocynth* and the eatable "*water-melon* have associated with them here a cookable vegetable.

"In Sindh it is cultivated from April to September, generally in the same plot of ground with common "melons, Luffa, gourds and cucumbers. The fruit is picked when about two-thirds grown, the size and shape "of a common field-turnip, two inches-and-a-half high, and three inches-and-a-half across. It is pared, cut "in quarters, the seeds extracted, well boiled in water, and finally boiled in a little milk, with salt, black-"pepper, and nutmeg. Mussalmans generally cut it into dice, and cook it together with meat in stews or "curries. Hindus fry it in *ghi* with split gram-peas (*Cicer arietinum*), and a curry powder of black-pepper, "cinnamon, cloves, cardamoms, dried cocoanut, turmeric, salt, and last (but not least in their opinion) the "never failing *asafœtida*. It is sometimes made into a preserve in the usual manner. It is sometimes "picked when small, cooked without scraping out the seeds, and regarded a greater delicacy than when more "advanced."

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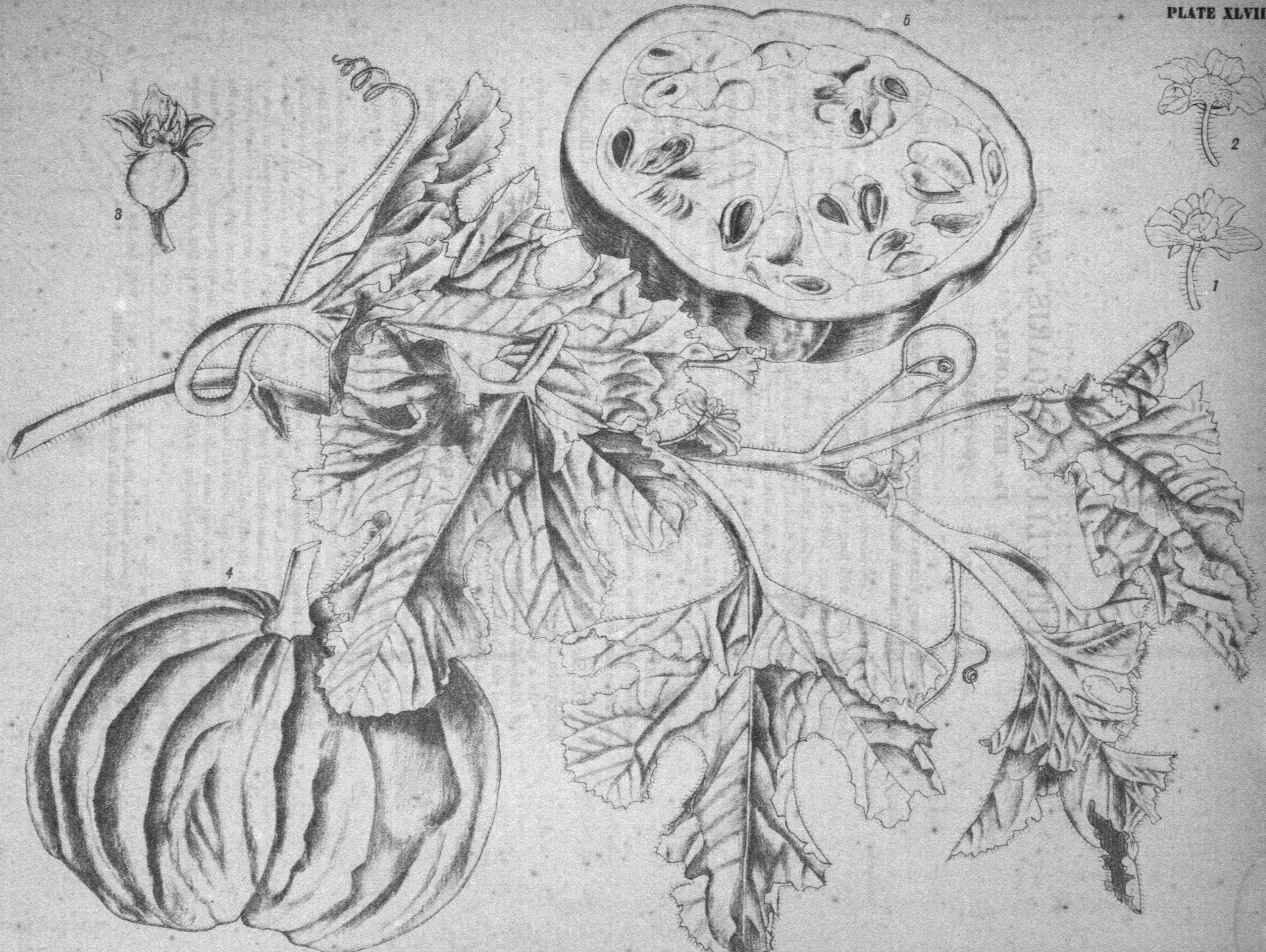
* References:—*C. fistulosus*, Stocks in Hook. Journ. Vol. iii. p. 74. t. 3; Walp. Ann. Bot. Syst. iv. 863. *C. vulgaris*, Schrad. in DC. Monogr. Phan. iii. 509; Clarke in Hook. Fl. Brit. Ind. ii. 621.



Drawn by H. Hormanji

CITRULLUS FISTULOSUS, Stocks.

Litho T. C. Press, Roorkee.
Thos. D Bona, Supdt.

Distribution and Season.

In these Provinces the cultivation of *tensi* is confined to the western districts. It is sown shortly before the rains, and is eaten during the rainy season. It is grown in well manured ground either as a sole crop or mixed with other vegetables. It is highly thought of as a vegetable, and is cooked in the manner already described. The seeds, according to Royle, are used medicinally.

Explanation of Plate XLVII.

1. } Male flower,
2. }
3. Female flower, } slightly enlarged.

4. Fruit,
5. Ditto, vertical section, } nat. size.

Drawn from a living specimen gathered at Saháranpur.

LAGENARIA VULGARIS, *Seringe.**

[*Vide* Plate XLVIII.]

ENGLISH, **bottle gourd**; VERNACULAR, **kaddú, al-kaddú, lauki, kashiphal, and gol kaddú (Bijnor), tumri (small variety).**

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Whole plant softly pubescent. Stems extensively trailing or climbing, thick, 5-angled ; tendrils 2-fid. Leaves on long petioles ; petiole almost round with a deep furrow on the upper surface and with a short conical gland on either side at its apex ; limb cordate orbicular, often 6 in. in diameter, obscurely 3-5-lobed, rounded or acute at the apex ; basal sinus rather deep ; veins prominent beneath and pedately arranged. Flowers large, white, solitary, monœcious. Male flower :—peduncle often 6 in. long, slender, angular, sulcate. Calyx tube campanulate ; teeth 5, subulate. Petals crumpled, emarginate or mucronate at the apex, hairy on both sides especially towards the base ; stamens 3 ; anthers conduplicate. Female flowers :—peduncle thicker and much shorter than that of the male ; calyx and corolla as in the male ; ovary oblong, softly pubescent ; style short, bearing 3 bifid stigmas. Fruit variable in shape and size, usually bottle or dumbbell-shaped. Seeds $\frac{5}{8}$-$\frac{3}{4}$ in. long, white, obovate oblong or triangular, or bidentate at the apex, with a groove within the margin.

Origin.

This plant has been found wild in India, the Moluccas and also in Abyssinia.† It is now cultivated in most warm climates, including America, China and Australia.

Varieties.

The numerous varieties of this species are chiefly distinguished by the character of the fruit which assumes all kinds of shapes from that of a siphon or flask to that of a turnip.

The fruit is eaten by Europeans as well as by Natives ; when cut young it takes the place of vegetable marrow. Natives boil and slice the whole fruit, or the pulp is eaten with vinegar or mixed with rice as a vegetable curry. The bottles used by beggars and others are the dried empty fruits of this species. The *tumri* variety is not edible ; its fruit is used for making the stringed instrument called *sitar*.

Mr. Gollan‡ gives the following information regarding the cultivation of this gourd :—

" It can be sown as early as February, and as late as July. However for rainy season use, two sowings " should be made, the first in April and the second in June. The first sowing will be ready for use in the " beginning of the rains. The second will come in about the middle, and keep up the supply until the cold " season. It can be sown in nurseries and transplanted, or sown at once where intended to be grown. The " latter mode is preferable, but if an empty plot is not available when the sowing season arrives, it is better to " adopt the first named, than let the sowing season slip past. It succeeds best in heavily manured sandy soil, " but will thrive ordinarily well in any. When sown or transplanted, the seeds or plants should be inserted

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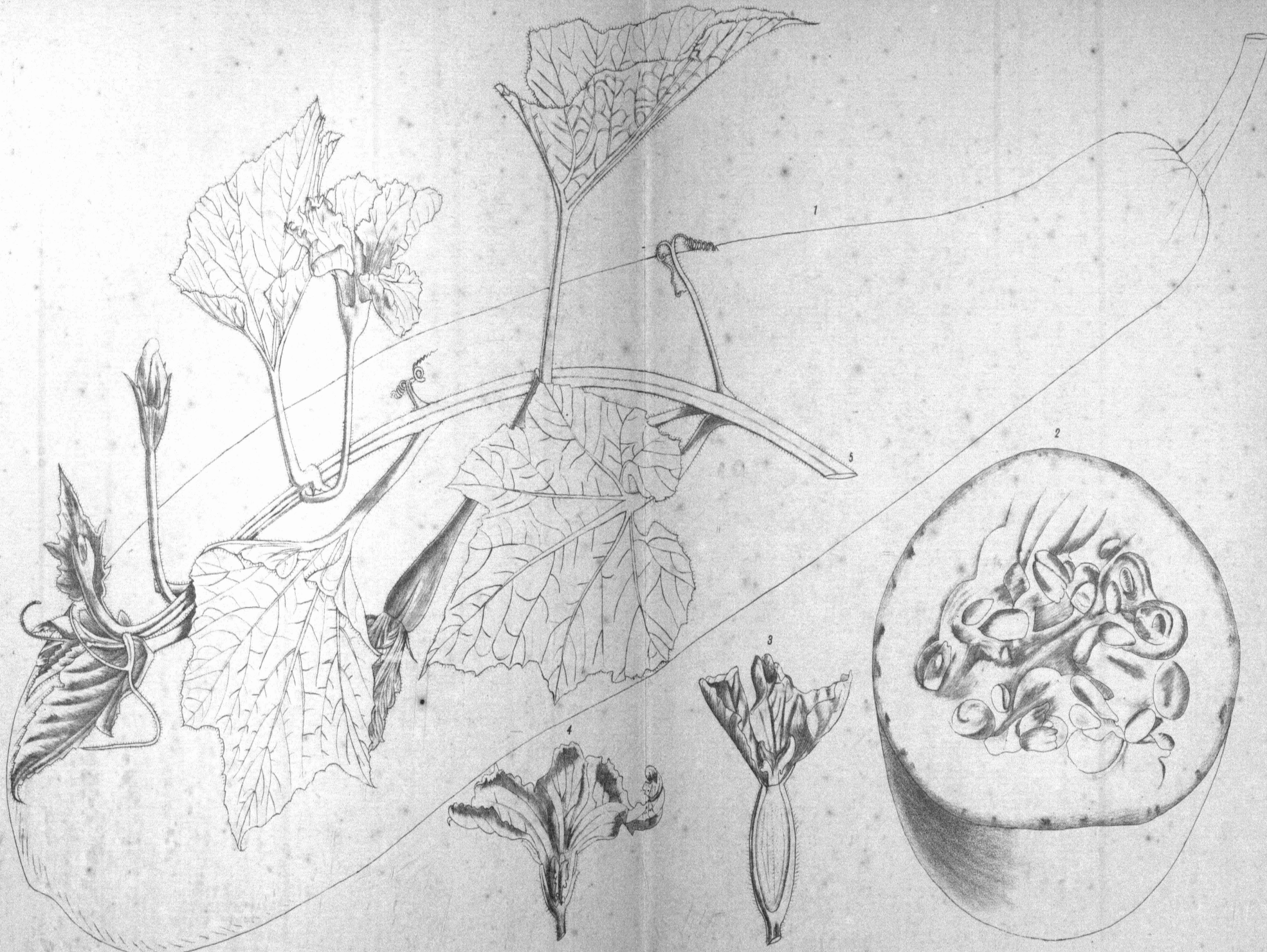
* **References** :—W. & A. Prod. 341 ; Wight Ill. t. 105; Hook. Fl. Brit. Ind. ii. 613 ; Baden-Powell Punj. Prod. 264 ; Atkinson Econom. Prod. N.-W. P. Part v. p. 5 ; Gaz. N.-W. P. Vol. x. 700 ; Naudin in Ann. Sc. Nat. Ser. 4 Vol. 12 p. 91 ; Cogniaux in DC. Mon. Phan. iii. 417 ; DC. L'Orig. Pl. Cult. 195 ; Indian Forester, Vol. ix. (1883) p. 202 ; *Cucurbita lagenaria*, Linn. ; Roxb. Fl. Ind. iii. 718. *C. Pepo.* Gaz. N.-W. P. Vol. x. 702 (in part).

† L'Orig. Pl. Cult. l. c.

‡ Ind. For. loc. cit.



LAGENARIA VULGARIS, SERINGE.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. B. Jones, *Superl.*

"in patches 6 feet apart. No supports are required, as it prefers to trail along the ground. It should be "weeded when necessary, until the patches interlace and cover the ground. Afterwards it will not require to "be touched, as the dense network of branches will keep down the weeds."

The following was the area under *kaddú* during the rainy season of 1880 in certain districts from which returns of its cultivation have been received. The figures will serve as an indication of its importance in different parts of the Provinces.

	Acres.
Allahabad, ...	202
Meerut, ...	140
Mainpuri, ...	76
Shahjahanpur, ...	61
Bulandshahr, ...	54
Bijnor, ...	37
Jalaun, ...	28

Explanation of Plate XLVIII.

1. Mature fruit,
2. Transverse section of ditto,

} nat. size.

3. Female flower, vertical section,
4. Male flower, vertical section,

} nat. size.

From a drawing of a living specimen cultivated at Sahâranpur.

CUCUMIS MELO, *Linn.**

Var. MOMORDICA.

(*Vide Plate* XLIX).

ENGLISH, none; VERNACULAR, **kachra** (unripe), **phunt** (ripe), **tuti**.†

Varieties.

This is one of the more marked varieties of *C. Melo*, differing only, however, as far as description can apply, in the form and nature of the fruit. The fruit is cylindrical and quite smooth, and when ripe bursts spontaneously. In size it varies from 1 ft. to 2 ft. long, and from 3-6 in. in diameter, and weighs from 4-8 lbs. The seeds are rather smaller than those of the common melon.

Roxburgh (Fl. Ind. l.c.) says of this plant:—

"The fruit is much eaten both by Natives and Europeans; when young they are a good substitute for the "common cucumber, and when ripe (after bursting spontaneously) with the addition of a little sugar they are "little inferior to the melon, and reckoned very wholesome."

Area.

The following is the area returned as under *phunt* during the rainy season of 1881 in certain typical districts:—

	Acres.
Bijnor, ...	212
Allahabad, ...	183
Shahjahanpur, ...	116
Muttra, ...	42
Aligarh, ...	17
Jhansi, ...	9
Mainpuri, ...	7

Explanation of Plate XLIX.

1. Ripe fruit, transverse section, } nat. size.
2. Entire fruit, }
3. Female flower, } enlarged.
4. Male flower, }
5. Portion of flowering branch (nat. size).

From a drawing of a living specimen cultivated at Saháranpur.

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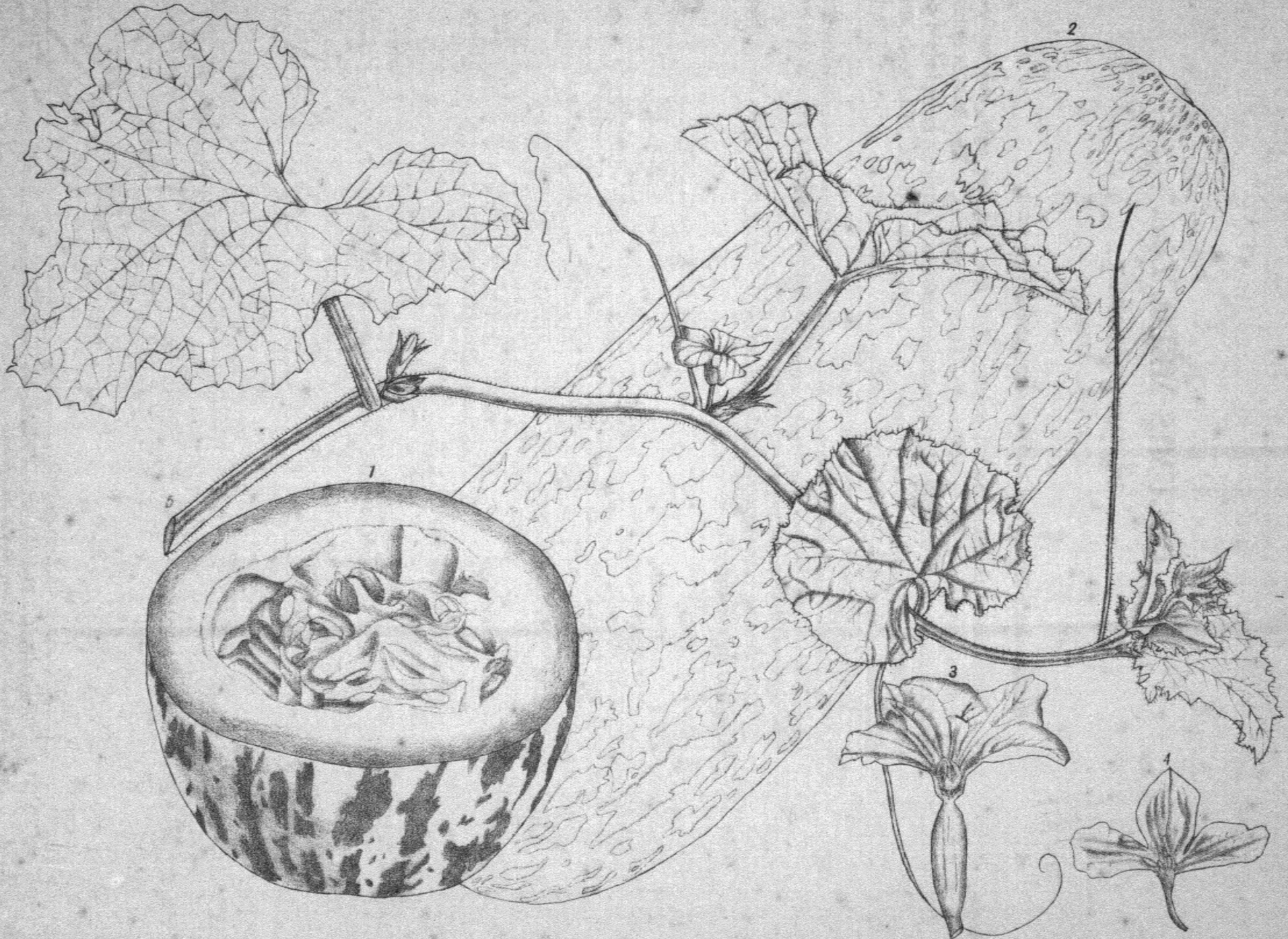
* **References**:—Cogniaux in DC. Mon. Phan. iii. 484; Atkinson Econom. Prod. N.-W P. Part v. p. 9. *C. Momordica* Roxb. Fl. Ind. iii. 720; W. & A. Prod. p. 342.

† Roxburgh l. c.



CUCUMIS MOMORDICA, ROXB.

Drawn by H. Hormusji.

Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

CUCUMIS MELO, *Linn.**

[*Vide* Plate L.]

ENGLISH, **melon**; VERNACULAR, **kharbuza.**

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. An annual, whole plant rough with hispid hairs. Stems creeping, scabrid and obscurely angled when young, becoming nearly round and smooth; tendrils simple, long and slender. Leaves about 3-in. across, puckered, orbicular reniform, or 3-7 lobed, the lobes rounded and coarsely denticulate, upper surface blueish green, light green below; veins forming a prominent network beneath; petiole 1½-3 in., angular, sulcate. Flowers in fascicles, shortly stalked, yellow, monœcious. Male flower :—calyx tube campanulate or subcylindrical, villous; teeth 5, shorter than the tube, erect or spreading; corolla greenish at the base and densely hairy within the tube; limb 5-parted, divisions ovate acute, extending about half way to the tube; stamens 3, filaments short, glabrous, anthers free, one 1-celled, two 2-celled, connective forming a terminal crest; lobes flexuose. Female flower :—calyx and corolla as in the male; style short, stigmas 3, obtuse; ovary pubescent. Fruit very variable in shape, spherical, ovoid, elongated, or contorted, downy or glabrous, never prickly; flesh usually sweetish. Seeds nearly ½ in. long, oblong, compressed, without a margin.

Origin.

The conclusions arrived at by M. A. Decandolle in his recently published work on the origin of cultivated plants indicate N.-W. India, Beluchistan and perhaps W. Tropical Africa as the countries in which this species has existed in a wild state.

Varieties.

The varieties of this species are very numerous, and include plants which not only differ very much in appearance, but also as to the uses to which they are applied; some, for instance *kakri* and *phunt* (*see* preceding article), being used only as vegetables. The distinguishing characters of all the varieties are confined almost entirely to the fruit,—as to its shape, size, and colour; M. Naudin has conclusively proved their specific identity by the experimental cultivation of every obtainable variety. The results of these experiments were published in the Annales des Sciences Naturelles, a reference to which has already been given.

From an agricultural point of view the melon is perhaps the most important species of the order, since it is grown to a large extent on sandy stretches in river beds, which could hardly be made to produce any other crop with profit. So soon as the sand banks are exposed by the falling of the river, operations commence by enclosing small plots with grass fences in order to protect them from the inroad of drifting sand. A plentiful stock of manure is then carried to the spot, and large holes dug at regular intervals throughout the plot, into which the manure is distributed. The melons are sown over the manure in the holes, which act therefore in the same manner as forcing beds.

This is the practise in growing melons in the beds of rivers such as the Ganges and Jumna, which consist almost wholly of white sand. Where the river deposit is of

* **References** :—Roxb. Fl. Ind. iii. 720; Kurz in Journ. As. Soc. Beng. (1877) Part ii. p. 102; Hook. Fl. Brit. Ind. ii 620; Naudin in Ann. Sc. Nat. Ser. 4 Vol. xviii.; Atkinson Ecom. Prod. N.-W. P. Vol. v. p. 9; Gaz. N.-W. P. Vol. x. 701; Cogniaux in DC. Mon. Phan. iii. 484; DC. L'Orig. Pl. Cult. 205.

richer quality and contains a mixture of organic matter, a much less amount of manure is required, and it is reported that occasionally manure is altogether dispensed with.

The melon beds commence fruiting in April, and continue yielding until they are overwhelmed by the rise of the river in June. When laid incautiously near the water level, they are not unfrequently submerged by the rise of stream which takes place during the hot weather months before the heat of the monsoon, and is due to the melting of snow on the higher ranges of the Himalaya.

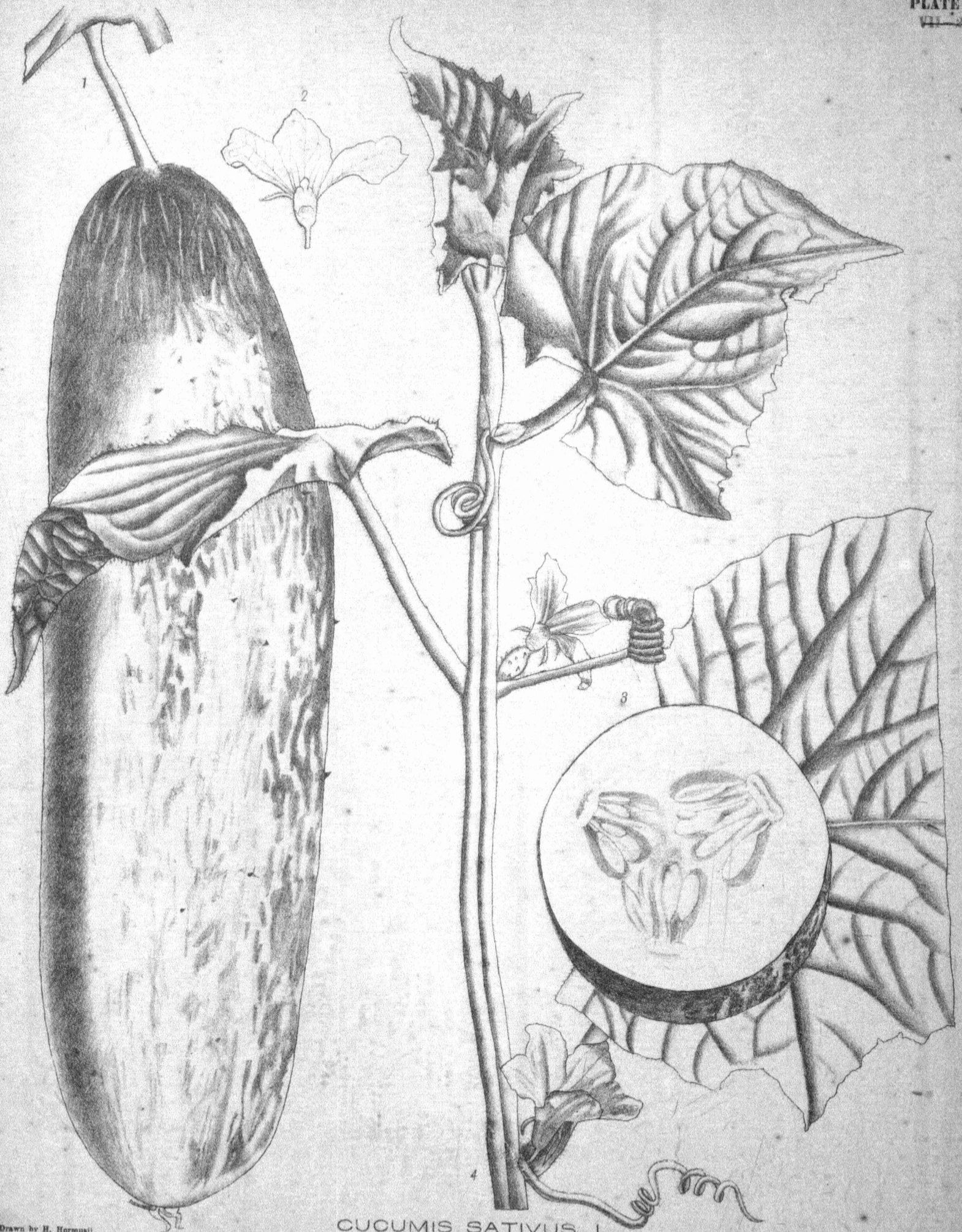
Area. The following is the area reported to bear melons during the hot weather in the 30 temporarily settled N.-W. Provinces districts, from which agricultural returns have been received. The figures represent the average of the returns for the three years 1879, 1880, and 1881. They probably include a certain amount of land under cucurbitaceous crops other than melons, of which *tarbuza* (water melon) is the chief. But they professedly relate to melons alone.

Meerut Division.	Rohilkhand Division.	Agra Division.	Allahabad Division, excluding Jaunpur District.	Benares Division, including Azamgarh, Basti and Gorakhpur Districts. only.	Jhansi Division.	Kumaun Division, including Tarai District only.	Total.
acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
5,268	5,687	5,626	4,465	283	2,121	133	23,583

Explanation of Plate L.

1. Transverse section of fruit.
2. Entire fruit.
3. Female flower.
4. Male flower.

From a drawing of a living specimen cultivated at Saháranpur.

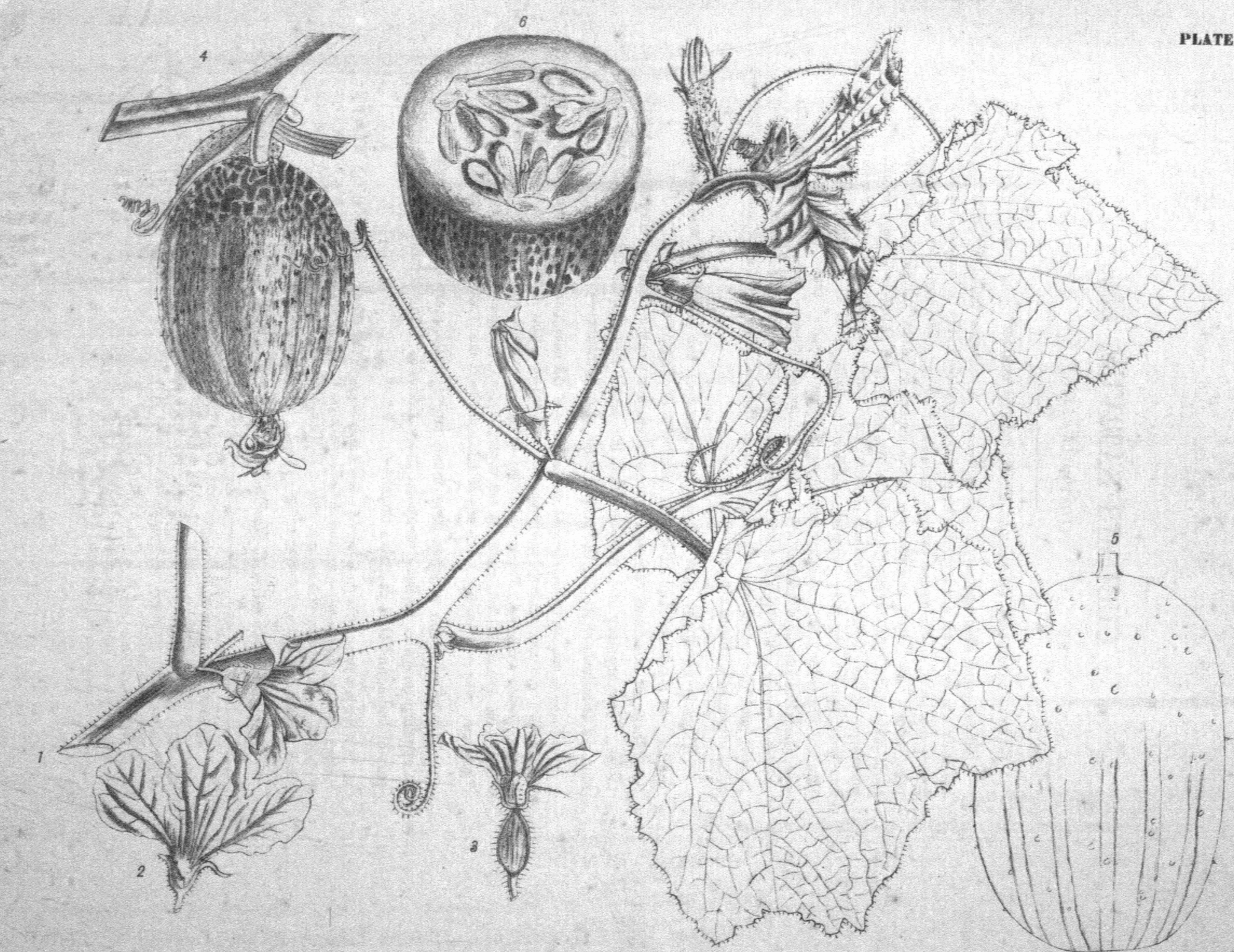


CUCUMIS SATIVUS, L.

Drawn by H. Hormuzji

Litho. T. C. Press, Roorkee.
Thos. D. Bonn, *Supdt.*

PLATE LII.



Drawn by H. Hormusji

CUCUMIS SATIVUS, LINN.
VAR.

Litho. T. C. Press, Roorkee,
Thos. D. Bons, Sundt.

CUCUMIS SATIVUS, *Linn.**

[*Vide* Plates LI. and LII].

ENGLISH, **cucumber**; VERNACULAR, **khira**; Sanscrit, **sukasa**.†

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. A scabrous trailing or climbing annual. Stems little branched, angular; tendrils simple (much reduced in the trailing hot weather variety). Leaves 3-5 lobed, sub-triangular cordate, undulate, very rough on both sides, dark green above, paler beneath; lobes acute or acuminate, with a dentate or crenate margin; petioles about equal to the blade, stout, solid, deeply channelled above, and hispid. Flowers shortly stalked, yellow, monœcious. Male flowers in axillary clusters; calyx tube campanulate, very hairy, teeth subulate about equal to the tube, spreading or reflexed; corolla about 1½ in. across, divided more than half way towards the base, hairy outside especially on the veins; stamens 3, anther lobes flexuose, connective forming a terminal crest. Female flowers solitary or fascicled; calyx and corolla as in male; ovary ovoid, style short, with three oblong stigmas; fruit ovate or oblong, very variable in size, smooth or tuberculate, yellowish green or mottled with brown; seeds numerous, white, acute at each end, without a margin.

Origin.

There is no doubt that the original home of the cucumber was in Northern India.‡ As a cultivated plant in this country it is of great antiquity.

Varieties.

There are numerous varieties, some of them hot weather, others rainy season vegetables. The ordinary hot weather kind has small egg-shaped fruits. Mr. Gollan§ remarks as follows regarding the proper mode of cultivation:—

"In order to keep up the supply until the beginning of the rains, three sowings should be made, one "in the end of February, one in the middle, and one in the end of March. It will succeed fairly well in any "soil, but prefers a rich one. The ground should be laid out in drills, one foot apart. Sow the seeds "along both sides of the drill, and if the soil is very dry, water immediately after sowing. After they "germinate, water every ten days. This vegetable, like the *kakri*, should not be watered too often."

The rainy season varieties have much larger fruits, more like the English kind in appearance. Mr. Gollan‖ mentions two varieties as being commonly grown in this part of India, and thus describes them:—

"When in a young state the colour of one is a dark green, and of the other creamy-white. When full "grown both are about a foot long, and the colour changes to a rusty brown. These two, although not "equal to the commonest varieties met with in England, are not to be despised. They thrive with little "care, and are always sure of yielding a crop."

Another variety called *C. Hardwickii*, Royle, grows wild on the Himalayas, and is

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* **References**:—Roxb Fl Ind. iii. 720; W. & A. Prod. 342; Kurz in Journ. As. Soc Beng 1877 Part ii p 103; Naudin Ann. Sc. Mat. Ser. 4 Vol. xi. p. 27; Hook Fl. Brit Ind. ii. 620; Atkinson Econom Prod N.-W. P. Part v p 9; Gaz N.-W. P. Vol. x. 701; Cogniaux in DC Mon Phan. iii. 498; DC. L'Orig. Pl. Cult. 210; Ind. For. Vol. ix. (1883) pp. 162 and 201. *C. Hardwickii*, Royle Ill. 220 t. 47 f. 3.

† Piddington Index 26.

‡ DC. L'Orig. Pl. Cult. l.c.

§ Indian Forester Vol. ix. (1883) p. 162.

‖ Indian Forester Vol. ix. (1883) p. 201.

frequently met with at low elevation; this is the *air alu* of Kumaun,* and *pahari indráyan* of the plains.

Area.

The area occupied by *khira* during the rains of 1881 is given below for certain typical districts. This is exclusive of the area on which it was grown as a hot weather crop and cleaned off the ground before August. The figures therefore greatly under-estimate the total area on which it was cultivated.

	Acres.
Allahabad, ...	183
Budaun, ...	153
Shahjahanpur, ...	80
Hamirpur, ...	48
Mainpuri, ...	42
Jalaun, ...	26
Meerut, ...	15

Explanation of Plate LI.

1. Mature fruit,
2. Male flower, vertical section,
3. Transverse section of fruit,

} all nat. size.

Explanation of Plate LII.

1. Portion of branch,
2. Male flower, vertical section,
3. Female flower, vertical section,

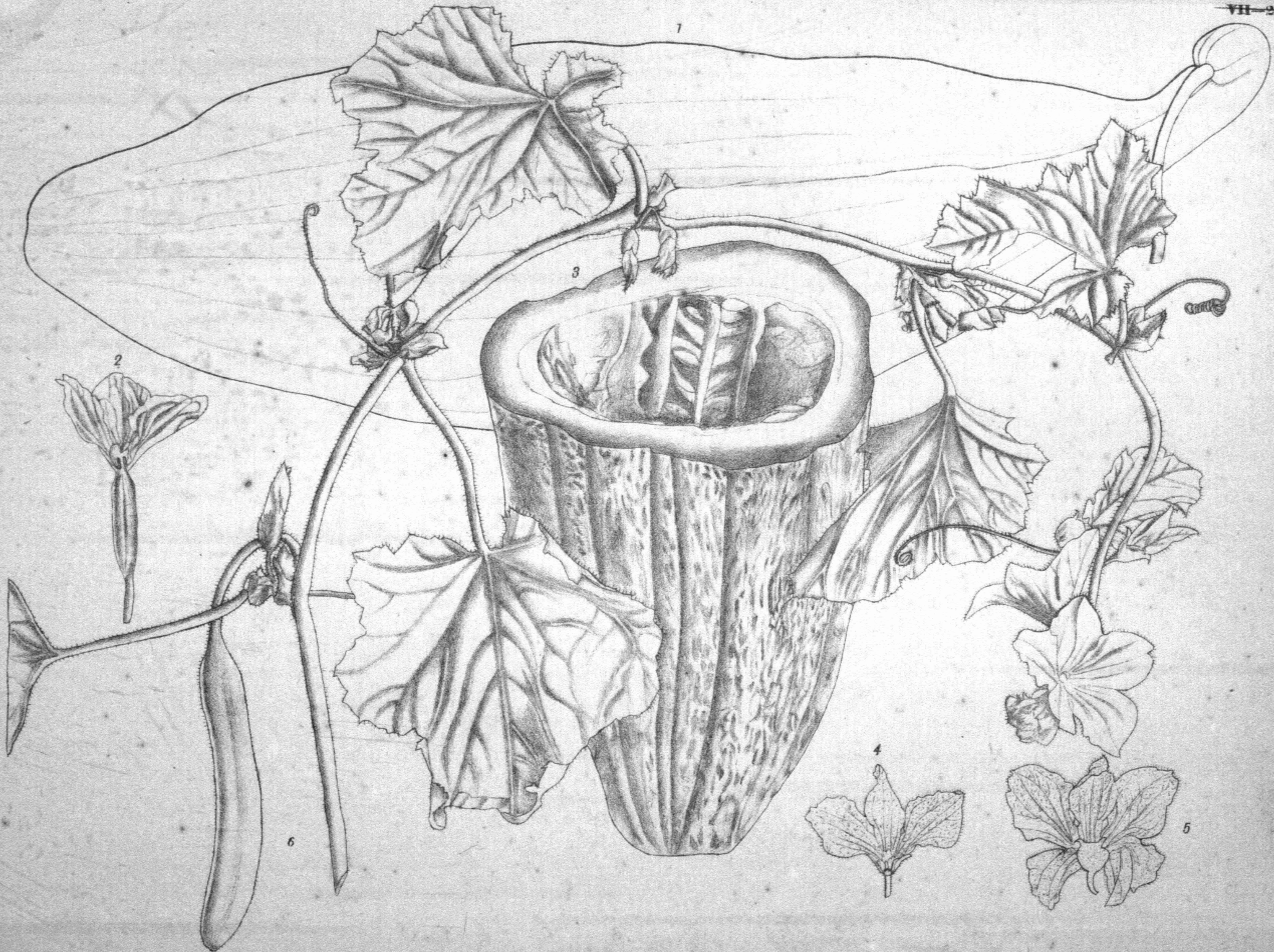
4 & 5. Mature fruit,

6. Transverse section of ditto,

} all nat. size.

The above Plates are from drawings of living specimens cultivated at Saháranpur.

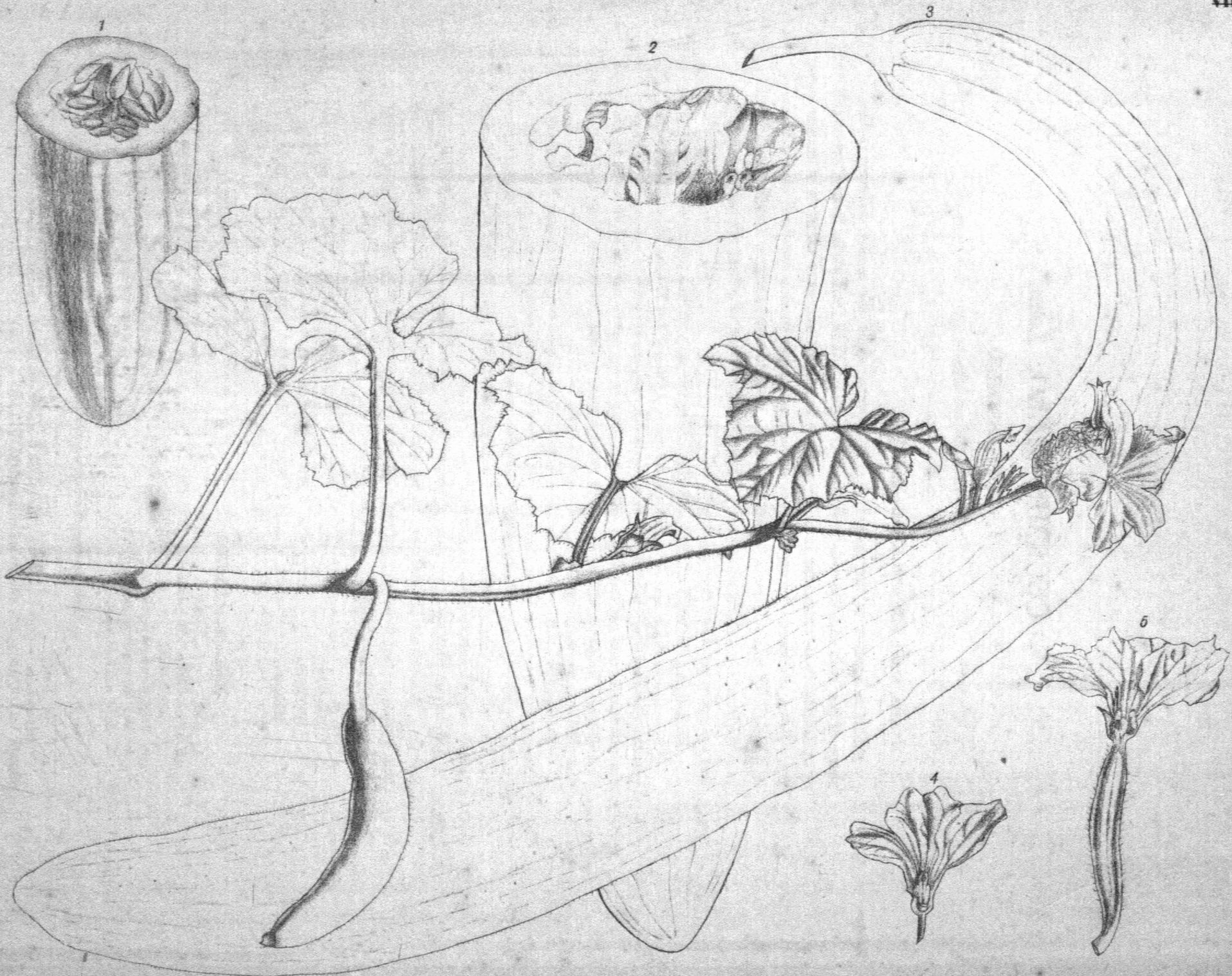
* Royle Ill. t. 47.



Drawn by H. Hormusji.

CUCUMIS UTILISSIMUS, ROXB.

Litho. T. C. Press, Roorkee.
Thos. D Bona, *Supdt.*



CUCUMIS UTILISSIMUS, ROXB.
VAR.

Drawn by H. Hormanji

Litho. T. C. Press, Bombay.
Thos. D. Bona, Sujdt.

CUCUMIS MELO, *Linn.**

Var. UTILISSIMUS.

(*Vide* Plates LIII. and LIV).

ENGLISH, none; VERNACULAR, **kakri, kakri reti.**

Varieties.

This is another of the extreme forms or varieties of the melon, differing in the shape of the fruit, and the uses to which it is applied. The fruit varies from short oval or cylindrical to elongate, and is either straight or curved like some varieties of cucumber. Some specimens grown this year in the Saháranpur garden measured over a yard in length. They also vary in colour from dark green to nearly white, usually changing to a bright orange colour when ripe. The seeds, like those of *phunt*, are rather smaller and more slender than true melon seeds.

Roxburgh (Fl. Ind. l.c.) makes the following remarks on this plant:—

"This appears to me to be by far the most useful species of *Cucumis* that I know; when little more than "one-half grown, they are oblong, and a little downy, in this state they are pickled; when ripe they are about "as large as an ostrich's egg, smooth and yellow; when cut they have much the flavour of the melon, and "will keep good for several months if carefully gathered without being bruised and hung up; they are "also in this stage eaten raw and much used in curries by the Natives.

"The seeds like those of other Cucurbitaceous fruits contain much farinaceous matter blended with a "large portion of mild oil; the natives dry and grind them into a meal, which they employ as an article of "diet; they also express a mild oil from them, which they use in food and to burn in their lamps. Experi-"ence, as well as analogy, prove these seeds to be highly nourishing and well deserving of a more extensive "culture than is bestowed on them at present."

Kakri is an important article of food with the poorer classes during the hot weather months. Unfortunately there are no statistics of the area on which it is grown during this season. The following figures show the area which it occupied during the rainy season of 1881 in certain typical districts:—

	Acres.		Acres.
Allahabad, ...	640	Muttra, ...	24
Fatehpur, ...	110	Azamgarh, ...	18
Mainpuri, ...	29	Pilibhit, ...	14

Explanation of Plate LIII.

1. Fruit,
2. Female flower with portion of corolla removed,
3. Fruit, transverse section,
4. Male flower, vertical section,
5. Ditto, seen from below,

} all nat. size.

Explanation of Plate LIV.

1. Young fruit, transverse section,
2. Mature fruit, transverse section,

} nat. size.

3. Ditto entire (reduced ½).
4. Male flower, vertical section,
5. Female flower, vertical section,

} nat. size.

From drawings of living specimens cultivated at Saháranpur.

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* **References**:—*C. utilissimus*, Roxb. Fl. Ind. iii. 721; Atkinson Econom. Prod. N.-W. P. Part v. p. 9; Indian Forester Vol. ix. (1883) p. 161. See also authorities under *C. Melo*. p. 51.

CITRULLUS VULGARIS, *Schrad.**

[*Vide* Plates LV. and LVI.]

ENGLISH, **water melon**; VERNACULAR **tarbuza, kalinda, hindwana**;† Sanscrit, **chaya-pula**.‡

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. A climbing or trailing hispid annual. Stems branching, angular; tendrils 2-fid, firm; pubescent. Petioles about 2 in., nearly round, villous; blade of leaf 3-5 in. long by 2-3 in. broad, triangular ovate, cordate, deeply trifid, segments pinnatifid or bi-pinnatifid, terminal one larger; lobes undulate or lobulate, pale green above, ashy beneath. Flowers monœcious, axillary, solitary, rather large. Male flower:—peduncle falling short of the petiole; calyx tube broadly campanulate; lobes narrowly lanceolate, equalling the tube; corolla about an inch in diameter, greenish outside and villous; segments ovate, oblong, obtuse, 5-nerved. Stamens 3, anthers free. Female flowers:—calyx tube fused with the ovary, contracted above, lobes and corolla as in the male; ovary ovoid, densely villous; style short; stigmas 3. Fruit large ovoid, dark green or mottled, sometimes covered with a glaucous waxy bloom; flesh white yellowish or red. Seeds compressed and usually margined, varying much in shape and colour.

Origin.

The water melon is indigenous in the equatorial regions of Africa.§ The fruit of the wild plant may be bitter or sweet without any observable difference externally.

The well-known fruit yielded by this plant seems to be universally appreciated by the Natives, and is by no means despised by Europeans. Though deficient in flavour it is always cool and refreshing.

It is usually sown in January or February, and the fruit ripens during the early part of the hot season.

As a crop it is a somewhat precarious one, being often entirely destroyed by untimely showers, or by severe hailstorms, which latter are by no means unfrequent during the time when the fruit is ripening.

Although largely cultivated in these Provinces, statistics are wanting to indicate even approximately the total area it has occupied during past years.

Area.

The following are the areas it has been reported to have occupied in certain districts during the rainy season of 1881:—

	Acres.		Acres.
Bulandshahr, ...	56	Farukhabad, ...	19
Jalaun, ...	48	Muttra, ...	3
Meerut, ...	26		

Explanation of Plate LV.

1 & 2. Male flower, } enlarged.
3. Female flower, }

Explanation of Plate LVI.

1. Fruit, transverse section.
2. Entire fruit, (reduced ½).

The above are from drawings of living specimens cultivated at Saháranpur.

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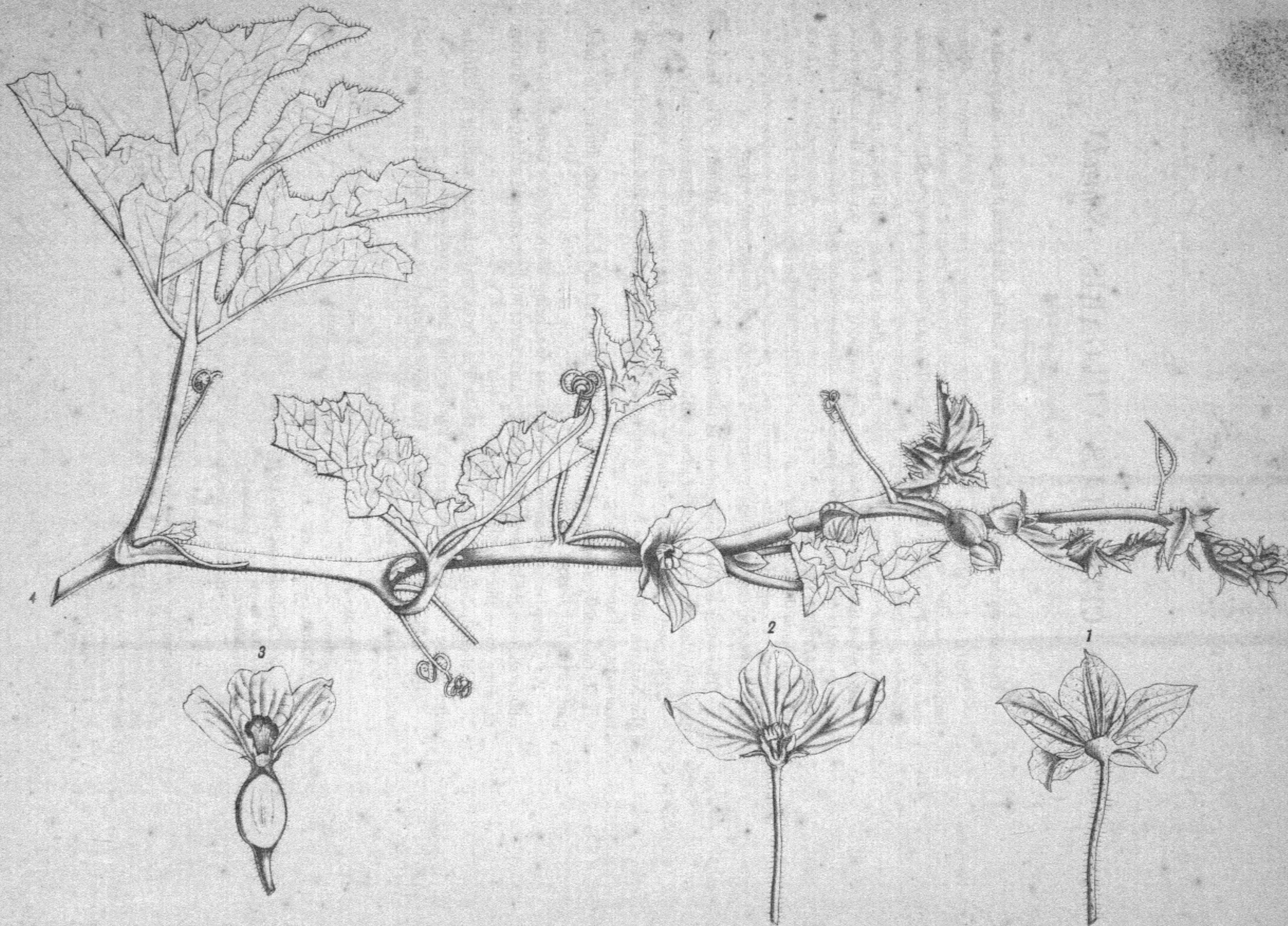
* **References**:—Naud. in Ann. Sc. Nat. Ser. 4 Vol. xii. p. 100; Hook. Fl. Ind. ii. 621; Atkinson Econom. Prod. N.-W. P. Part v. p. 10; Gaz. N.-W. P. Vol. x. p. 701; Cogniaux in DC. Mon. Phan. Vol iii. p 508; DC. L'Orig Pl. Cult. 209. *Cucumis Citrullus*, DC. Prod. iii. 301. *Cucurbita Citrullus*, Linn.; Roxb. Fl. Ind. iii. 719; W. & A. Prod. 351; Baden-Powell Punj. Prod. 264.

† Gaz. N.-W. P. Vol. x. 701.

‡ Piddington Index.

§ Decandolle l.c.

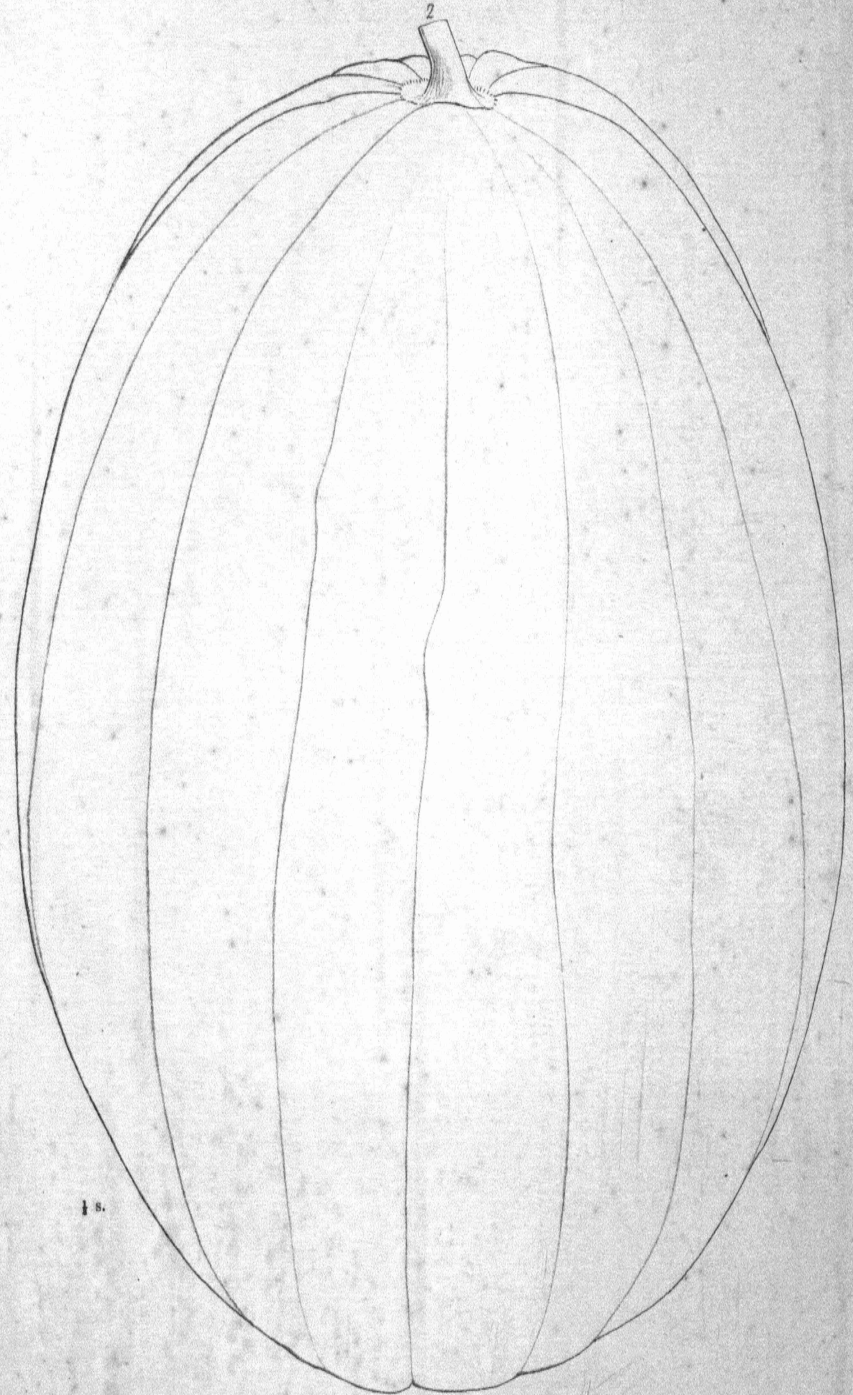


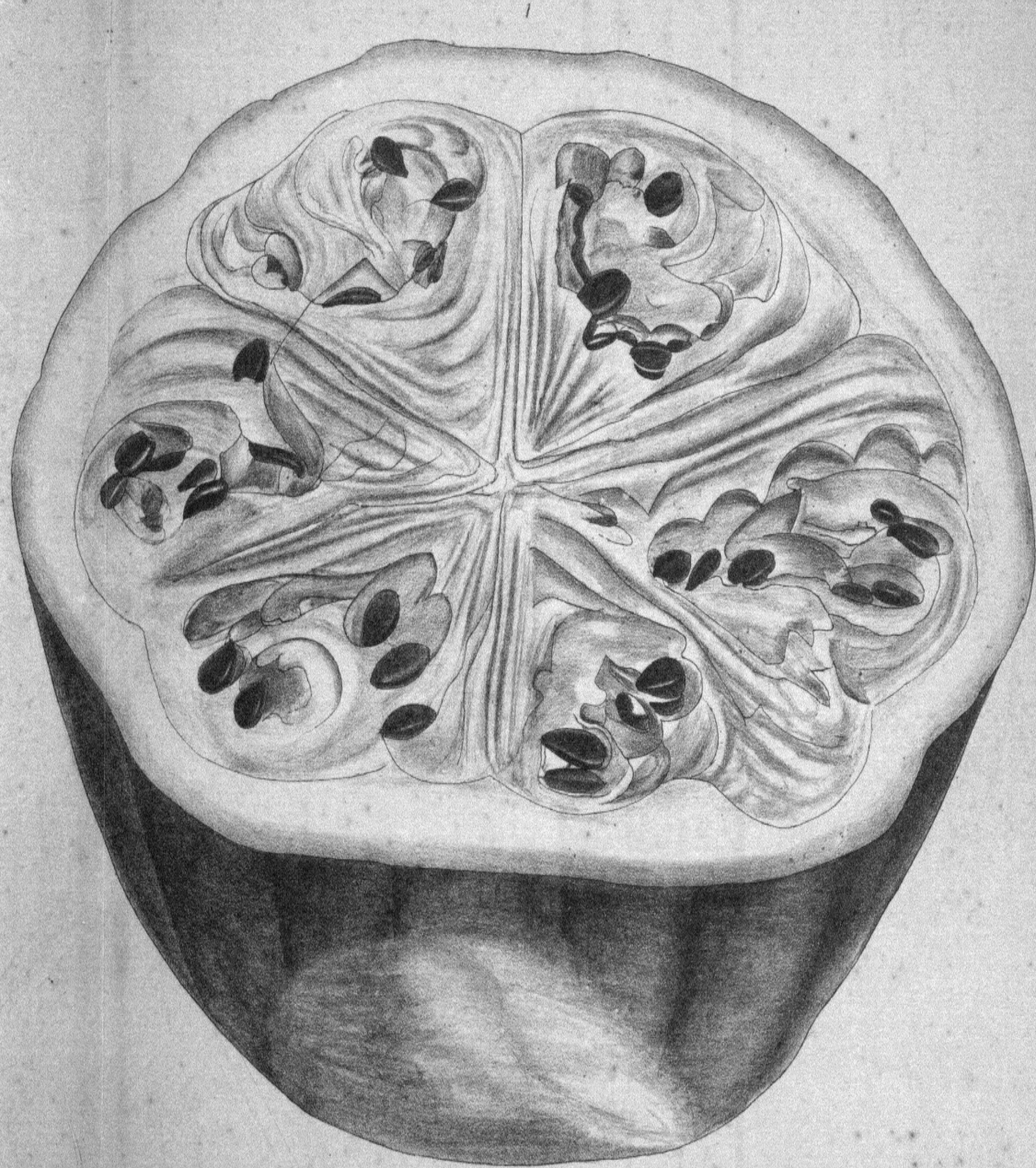
CITRULLUS VULGARIS, SCHRAD.

FL.

Drawn by H. Hormusji.

Litho. T. C. Press, Bourke.
Thos. D. Bonn, Supdt.

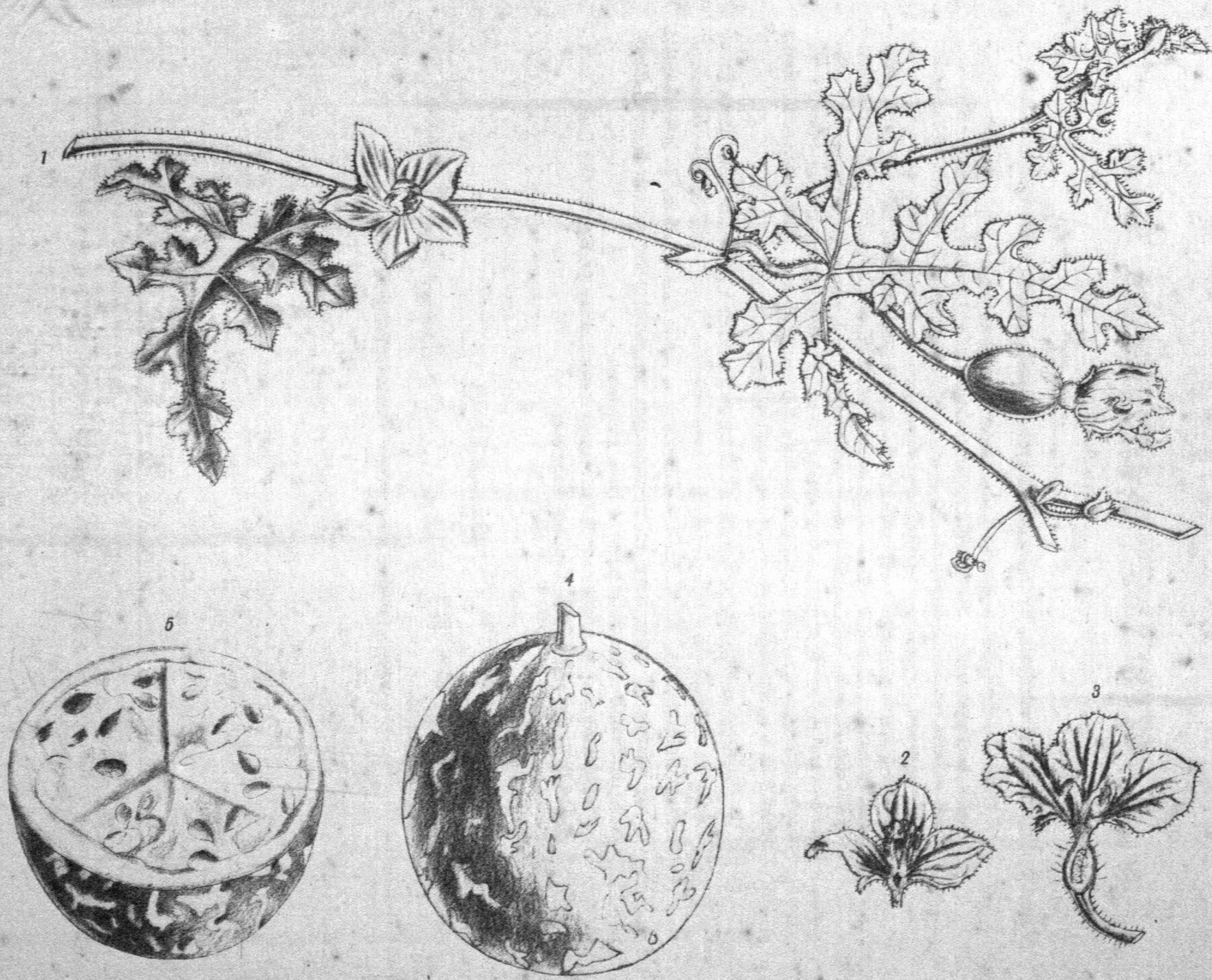




Drawn by H. Horanadi

CITRULLUS VULGARIS, SCHRAD. FRUIT.

Litho. F. C. Press, Roorkee.
Thos. D. Bona, Supdt.



CITRULLUS COLOCYNTHIS, SCHRAD.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.
Thos. D. Bona, *Supdt.*

CITRULLUS COLOCYNTHIS, *Schrad.*

[*Vide* Plate LVII.]

ENGLISH, **colocynth**; VERNACULAR, **indrayan, mukhál**; Sanscrit, **indra-varúni, vishala.**†

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. A scabrous trailing perennial herb. Stems slender, angular, branched ; tendrils bifid, slender. Leaves as in *C. vulgaris*, but smaller, stiffer and more scabrous, terminal segment more deeply cut ; petiole about 1 in. Flowers rather large, solitary, monœcious. Male flowers :—çalyx tube campanulate, hairy, lobes subulate recurved ; corolla pale greenish yellow, conspicuously veined, divisions extending more than half way down, ovate, acute, mucronate. Female flowers :—calyx tube fused with the ovary, contracted above, lobes and the corolla as in the male ; staminodes 3 ; ovary ovoid hairy. Fruit nearly globular 2-3½ in. in diameter, smooth or faintly grooved, dark green mottled with yellowish blotches arranged in undulating bands ; epicarp thin, coriaceous, yellow when dry ; pulp intensely bitter. Seeds chestnut coloured, about ⅓ in. long, smooth, obovate, compressed, not margined.

Colocynth can hardly be considered either as a field or a garden crop in these Provinces, for the fruits are collected from plants which are found wild in abundance on certain desert tracts of N.-W. India, and nowhere in India does it appear to be systematically cultivated. It is, however, an important medicinal plant, which is capable of being cultivated in the drier parts of these Provinces.

The part used as a medicine is the spongy seed-bearing portion of the fruit; it is intensely bitter, and acts as a strong purgative.

Explanation of Plate LVII.

1. Portion of flowering branch,
2. Male flower,
3. Female flower,

} all nat. size.

4. Fruit,
5. Ditto, transverse section,

} all nat. size.

From a drawing of a living specimen cultivated in Sahárunpur Garden.

* **References** :—Wight Ic. t. 498 ; Boiss. Fl. Orient. ii. 759 ; Bentley and Trim. Med. Pl. 114 ; Hook. Fl. Brit. Ind. ii. 620; Naudin in Ann. Sc. Nat. Ser. 4 Vol. 12 p. 99 ; Cogniaux in DC. Mon. Phan. iii. 510 ; Atkinson Econom. Prod. N.-W. P. Part v. p. 10 ; Gaz. N.-W. P. Vol. x. 701. *Cucumis Colocynthis*, Linn., W. & A. Prod. 342.

† Piddington Index 26.

CUCURBITA MOSCHATA, *Duchesne.*

[*Vide* Plates LVIII—LXI.]

ENGLISH, **musk melon**; VERNACULAR, **sitaphal, kumra, kaddú, mitha kaddú.**

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. A large hispid climbing or trailing herb. Stems extensive rarely short, thick, roundish or obscurely 5-angled; tendrils 4-5-fid. Leaves rather soft, bright green, blotched with white above, paler beneath, roundish reniform, 5-7-lobed, margin denticulate; petioles 2-5 in. thick, round, sulcate, hollow, hispid, but the hairs not pungent. Flowers solitary, large, yellow, monœcious. Male flower:—peduncle nearly round; calyx tube ½ in. in length, broadly campanulate, densely tomentose; segments 5, linear, erect, about 1¼ in.; corolla 3-4 in. greenish yellow outside, orange coloured and shining inside, hairy towards the base; segments cut about ⅓, reflexed, acuminate, hooded at the apex and mucronate; stamens 3, inserted near the base of the calyx tube; filaments free; anthers connate, cells conduplicate. Female flower:—peduncle 5-gonous; calyx tube very short; segments foliaceous; corolla as in the male; rudimentary stamens at the base of the calyx tube. Fruit of various shapes, cylindrical, ovoid clavate or sub-globose, or depressed at apex and base and more or less ribbed, dark green when young, covered with a delicate glaucous bloom when ripe. Seeds ¾ in. long by ½ in. wide, ovoid, compressed, margined.

It is a little difficult to distinguish this species from *C. Pepo* (pumpkin or vegetable marrow) and *C. maxima* (melon pumpkin) in all stages of its growth; Duchesne himself having failed to distinguish the two latter.† In this country the musk melon is usually known as *C. maxima*, an error which took root many years ago (*see* Wight's figures in his Icones and Illustrations), and has been adopted by many subsequent authors.‡ The hairiness of *C. moschata* is harsher than that of *C. maxima*, but much less so than that of *C. Pepo*, which is decidedly pungent. The leaves of *C. moschata* are usually marbled with whitish blotches; not so in *C. maxima*, rarely in *C. Pepo*. In *C. moschata* the peduncle of the female flower is angular, whereas in *C. maxima* it is nearly round. In *C. moschata* the calyx tube is very short and almost obsolete. A very distinct character is afforded by the leaflike calyx segments of the female flower of *C. moschata;* in *C. maxima* and *C. Pepo* they are subulate. The glaucous bloom on the ripe fruit of *C. moschata* is another distinguishing character.

Origin.

This is one of the three species mentioned by M. Decandolle in his recent work on cultivated plants, the origin of which are quite unknown.

The names vegetable marrow, pumpkin, and squash are loosely applied in India as in other countries. *C. Pepo*, that is the true vegetable marrow, is not, as far as we are

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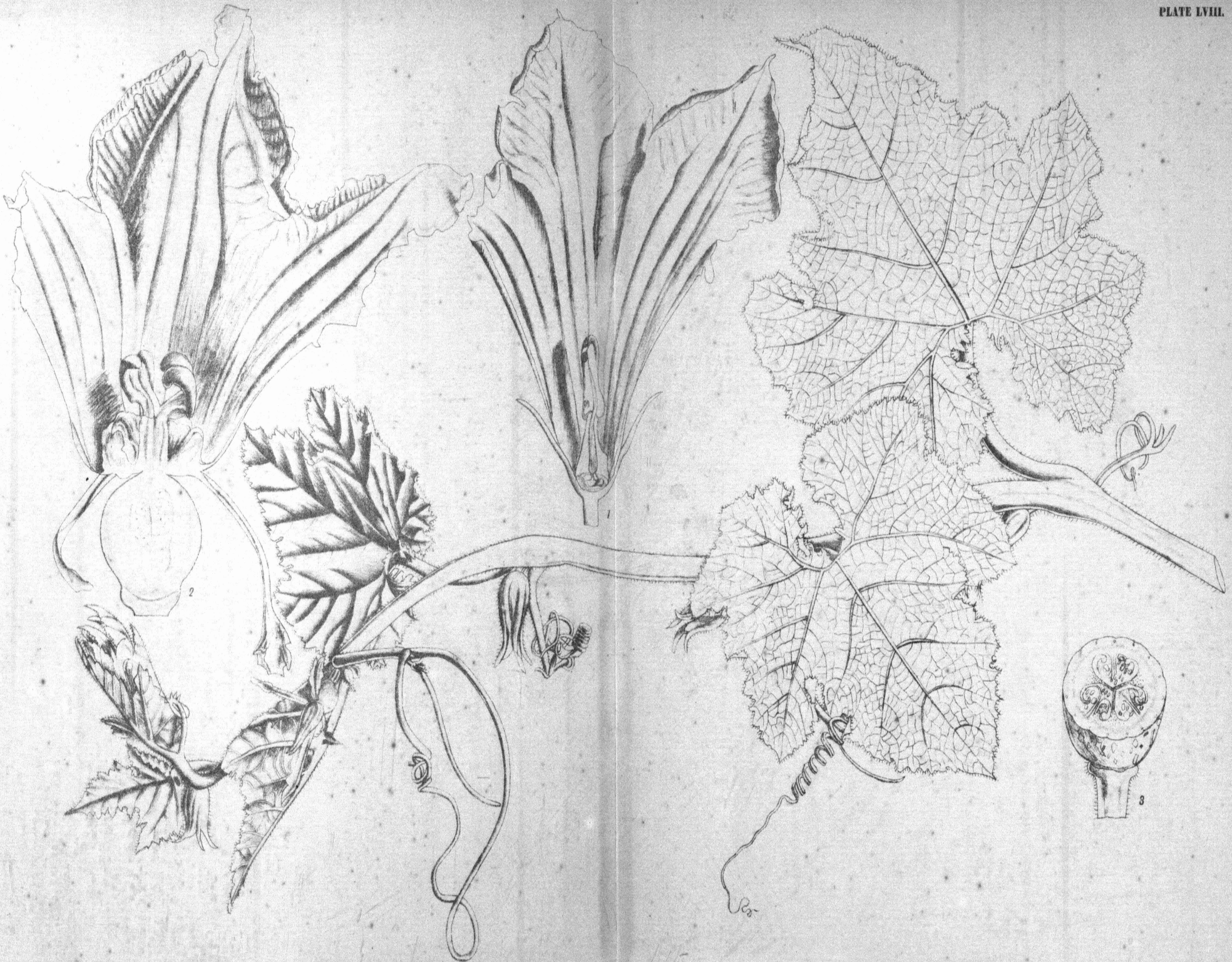
* **References:**—Naudin in Ann. Sc. Nat. Ser. 4 Vol. vi. 47; Hook. Fl. Brit. Ind. ii. 622; Atkinson Econom. Prod. N.-W. P. Part v. p. 11; Gaz. N.-W. P. Vol. x. p. 702; Cogniaux in DC. Mon. Phan. iii. 546; DC. L'Orig. Pl. Cult. 204. *C. Melopepo*, Lour.; Roxb. Fl. Ind. iii. 719. *C. maxima*, W. & A. Prod. 351; Wight Ill. t. 505; Ic. 507; Gaz. N.-W. P. l. c.; Indian Forester Vol. ix. (1883) p. 202. *C. Pepo*, Royle Ill. 218.

† See Naudin in Ann. Sc. Nat. l. c.

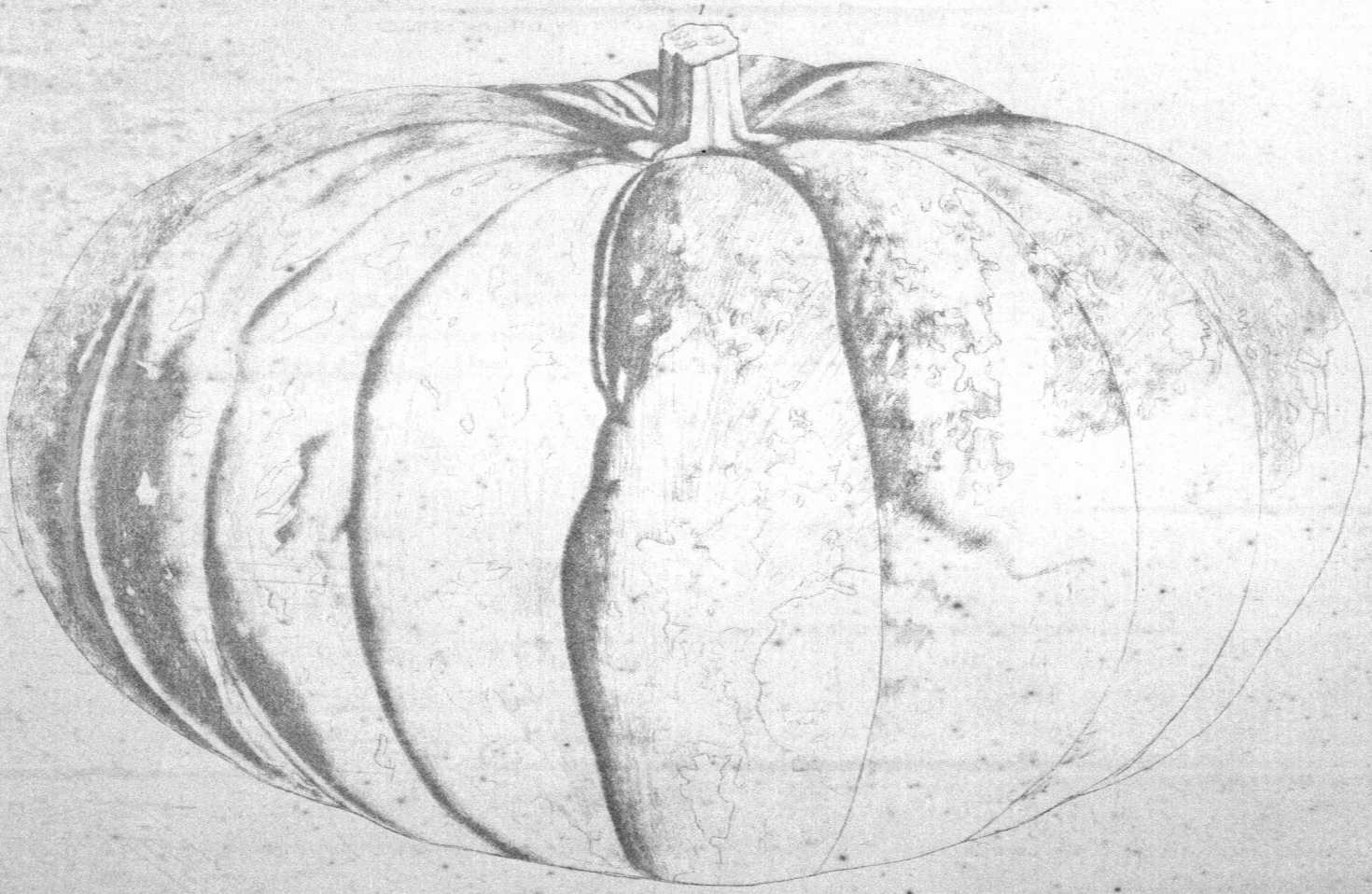
‡ In Atkinson's "Notes on the Economic Products of the North-Western Provinces, Part v., p. 11, his *C. maxima* and *C. moschata* are both *C. moschata*, Duch., and his *C. Pepo* on the following page is made up of *Benincasa cerifera* and *Lagenaria vulgaris*. The confusion with *Benincasa* originated with Loureiro in his Flora of Cochin China.

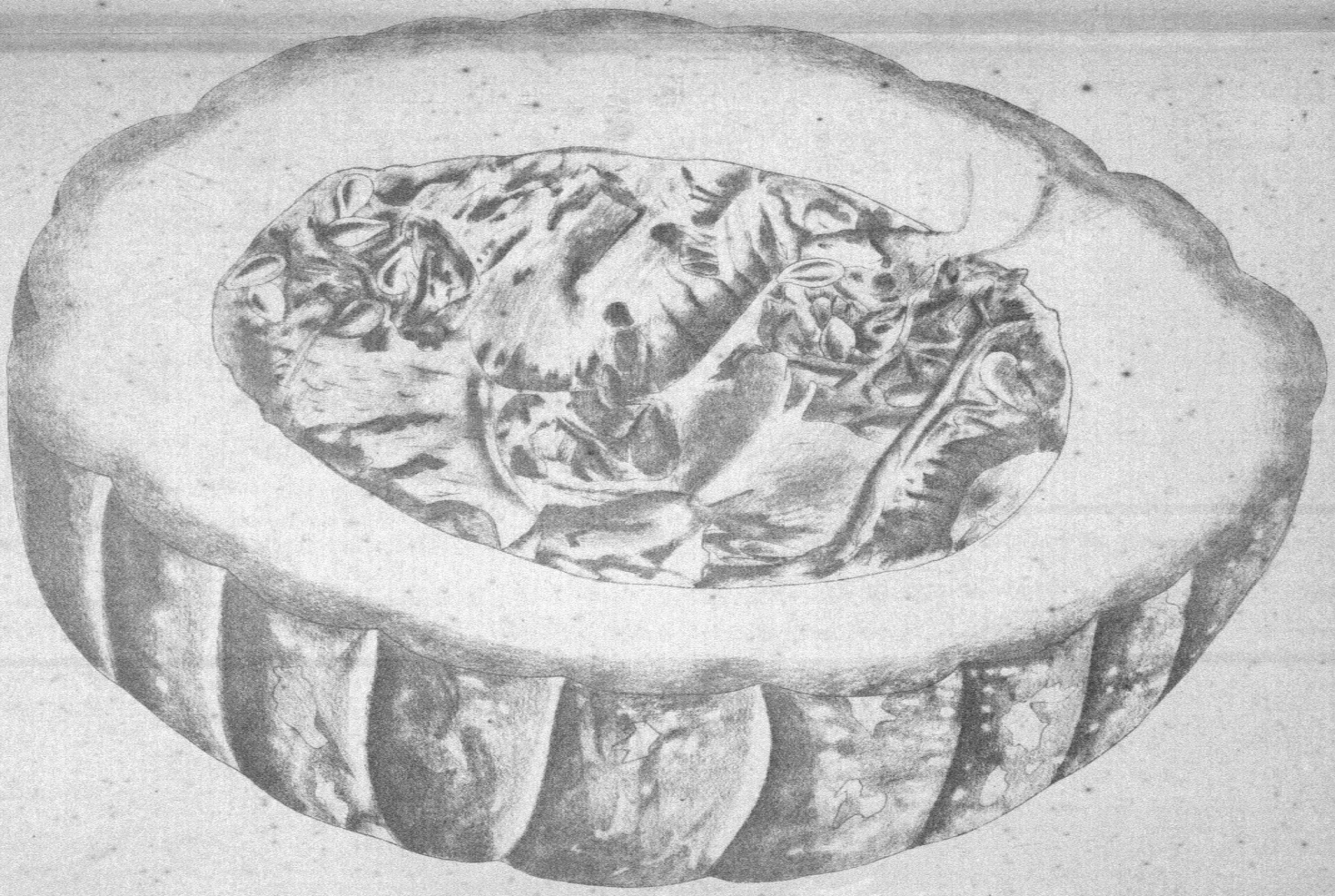


CUCURBITA MOSCHATA, DUCHESNE.
(FLOWER.)

Drawn by H. Horsnell.

Litho T. C. Press, Roorkee,
Thos. D. Bone, Supdt.

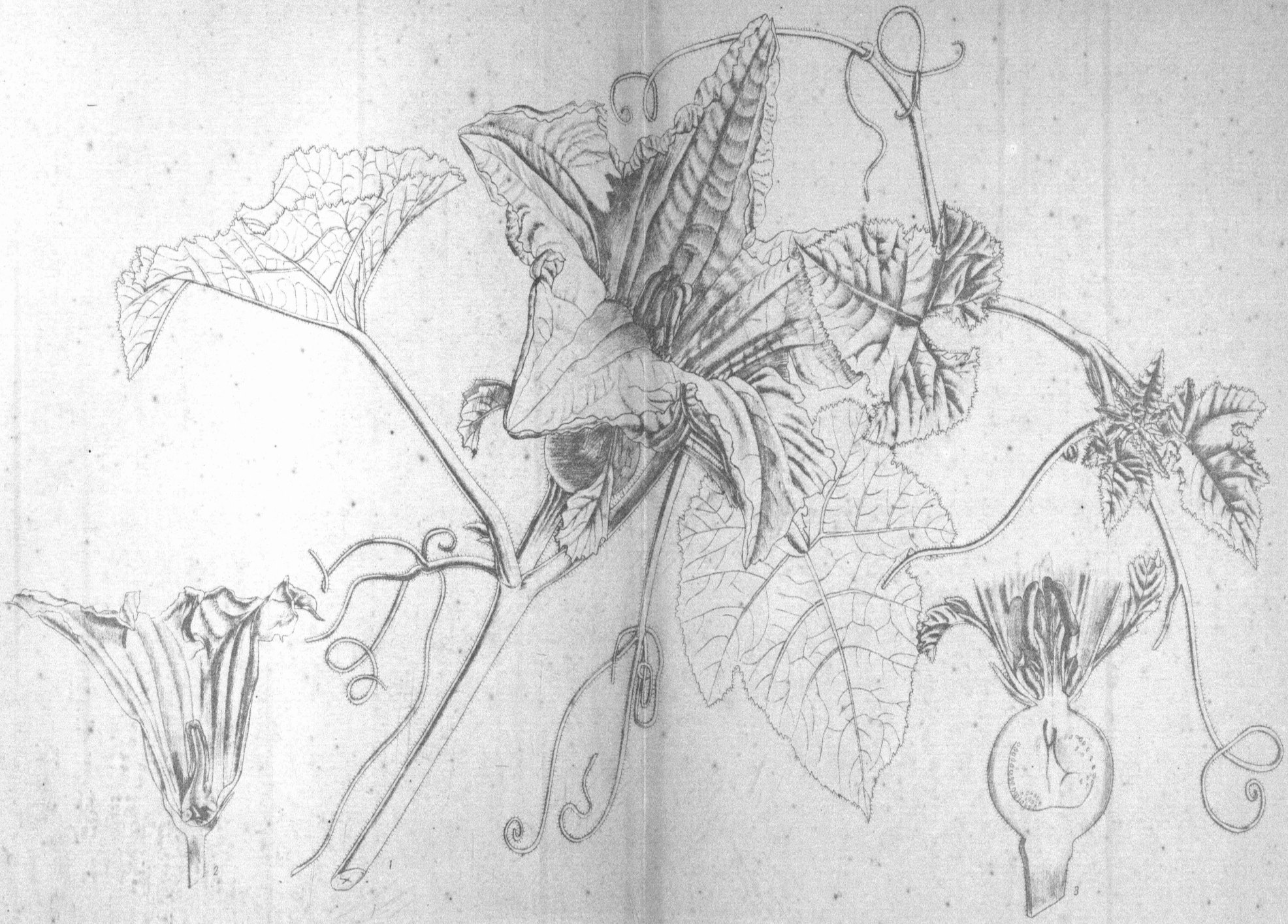




CUCURBITA MOSCHATA, DUCHESNE.
(FRUIT.)

Drawn by H. Hormuzji

Litho T. C. Press, Rochdale.
Thos. D. Sons, Sculpt.



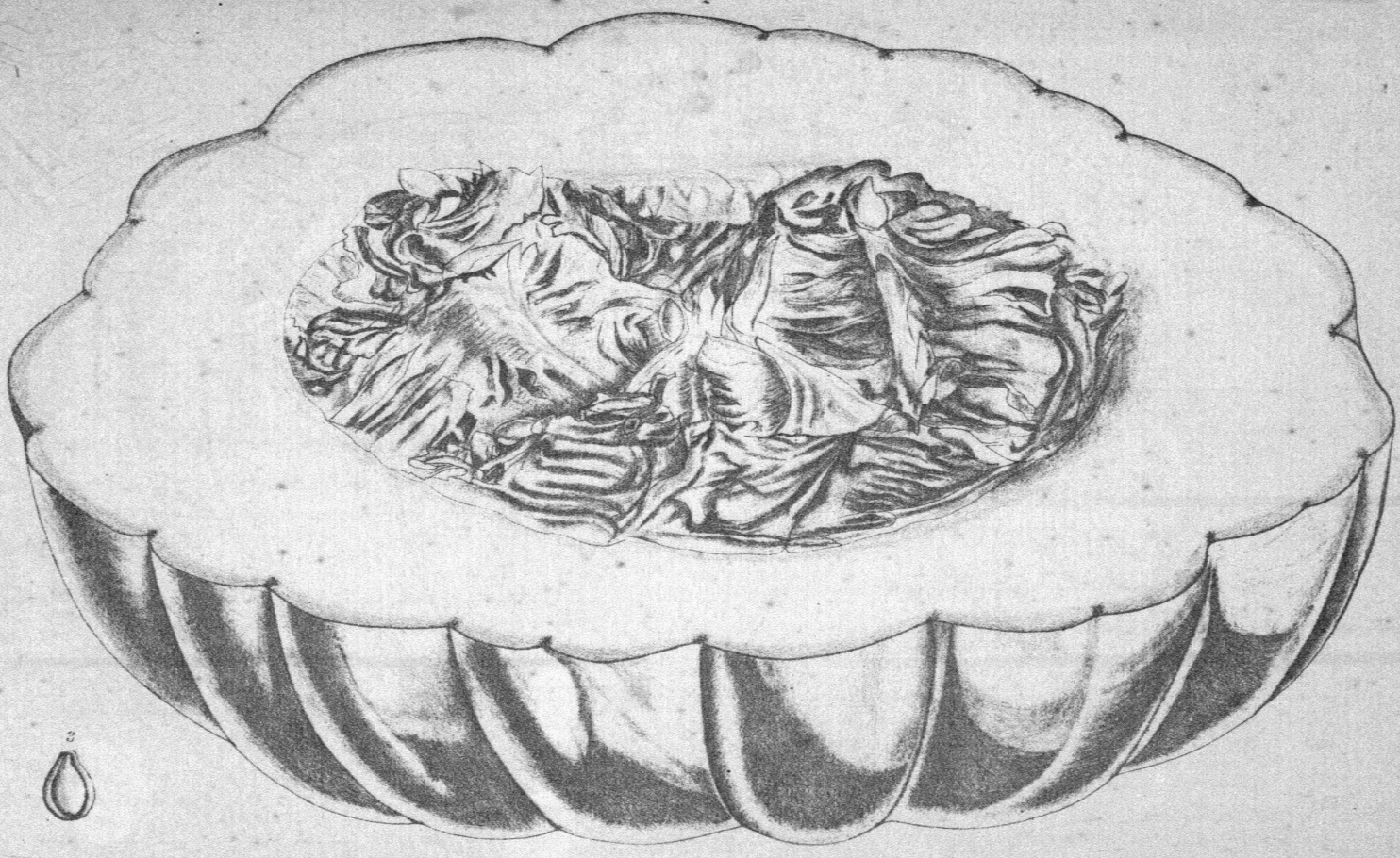
Drawn by H. Hormoy.

CUCURBITA MOSCHATA, DUCHESNE, VAR.
(FLOWER.)

Eithe T. C. Press, Roorkee.
Thos. D. Bone, Suptt.

1

2



3

Drawn by H. Hormusji

CUCURBITA MOSCHATA, DUCHESNE, VAR.
FRUIT.

Litho T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

aware, a cultivated crop of these Provinces; nor is *C. maxima* (the *potiron* of the French). A large number of specimens of cultivated cucurbitaceæ have been received from various Districts of these Provinces, but only one species of *Cucurbita* has as yet been detected, viz., *C. moschata*.

Area. No satisfactory statistics are available. The following is the area which it is said to have occupied in certain districts during the rainy season of 1881 :—

	Acres.
Farukhabad, ...	188
Cawnpore, ...	20
Jhansi, ...	19

Explanation of Plate LVIII.

1. Male flower,
2. Female flower, } vertical sections, } all nat. size.
3. Ovary, transverse section,

Explanation of Plate LIX.

1. Ripe fruit,
2. Transverse section of ditto } reduced to ½.

Explanation of Plate LX.

1. Extremity of flowering branch, Male flower, vertical section,
3. Lower portion of female flower, vertical section, } all nat. size.

Explanation of Plate LXI.

1. Ripe fruit,
2. Ditto, transverse section,
3. Seed (nat. size). } reduced to ½.

The above four plates are from living specimens cultivated at Sahâranpur.

LUFFA ACUTANGULA, *Roxb.**

[*Vide* Plate LXII.]

ENGLISH, none; VERNACULAR kâli taroi, kâli tori, satpatiya (Bundelkhand).

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Stems extensively trailing, slender, little branched, clothed with adpressed pubescence, 5-angled, angles winged; tendrils 3-6-fid. Petioles about 2 in., round or obscurely angled, with a deep furrow on the upper side. Leaves 3-4 in. across, palmately 5-7-angled, pale green, rough on both sides. Flowers rather large, pale yellow, monœcious; male and female from the same axil. Male flowers in erect axillary racemes (corymbose at first as in *Cruciferæ*, pedicels jointed near the middle, and with a thick spoon-shaped glandular bract a little below the joint; calyx tube turbinate, teeth lanceolate, acute, about equal to the tube, tuberculate at the base; corolla pubescent outside especially on the prominent veins; segments 5, obovate or obcordate, mucronate. Stamens 3, one 1-celled two 2-celled, filaments hairy below. Female flowers larger than those of the male, solitary, peduncles longer than the petioles, not jointed, calyx and corolla as in the male, but the latter sooner falling; style with three spreading stigmas; fruit about 1 ft. long, and 2-3 in. in width, smooth, clavate, obtuse, furnished with 10 sharp longitudinal ridges, and tipped with the persistent calyx segments;† seeds without a wing obovate, bilobed at the base, ½ in. long and ¼ in. broad, corrugated, black or mottled with grey.

Origin.

Indigenous in India and in the Indian Archipelago.‡

Uses.

The fruit of this species is much cultivated during the rainy season, and is highly valued as a vegetable. By the Natives it is used chiefly in curries; the half-grown fruits when boiled and dressed with butter, pepper and salt are, says Roxburgh, "little inferior to green peas."

Cultivation.

Mr. Gollan says §—

"Two sowings will keep up a supply from July until October. The first sowing should be made in April, "and the second in the end of May, or beginning of June. The seeds should be sown in lines at the same "distance apart as cucumbers."

No reliable information can be given as to its distribution and the area it occupies in these Provinces.

Explanation of Plate LXII.

1 & 3. Male flowers.
2. Female flower.
4. Fruit.
5. Transverse section of ditto.

From a drawing of a living specimen cultivated at Sahâranpur.

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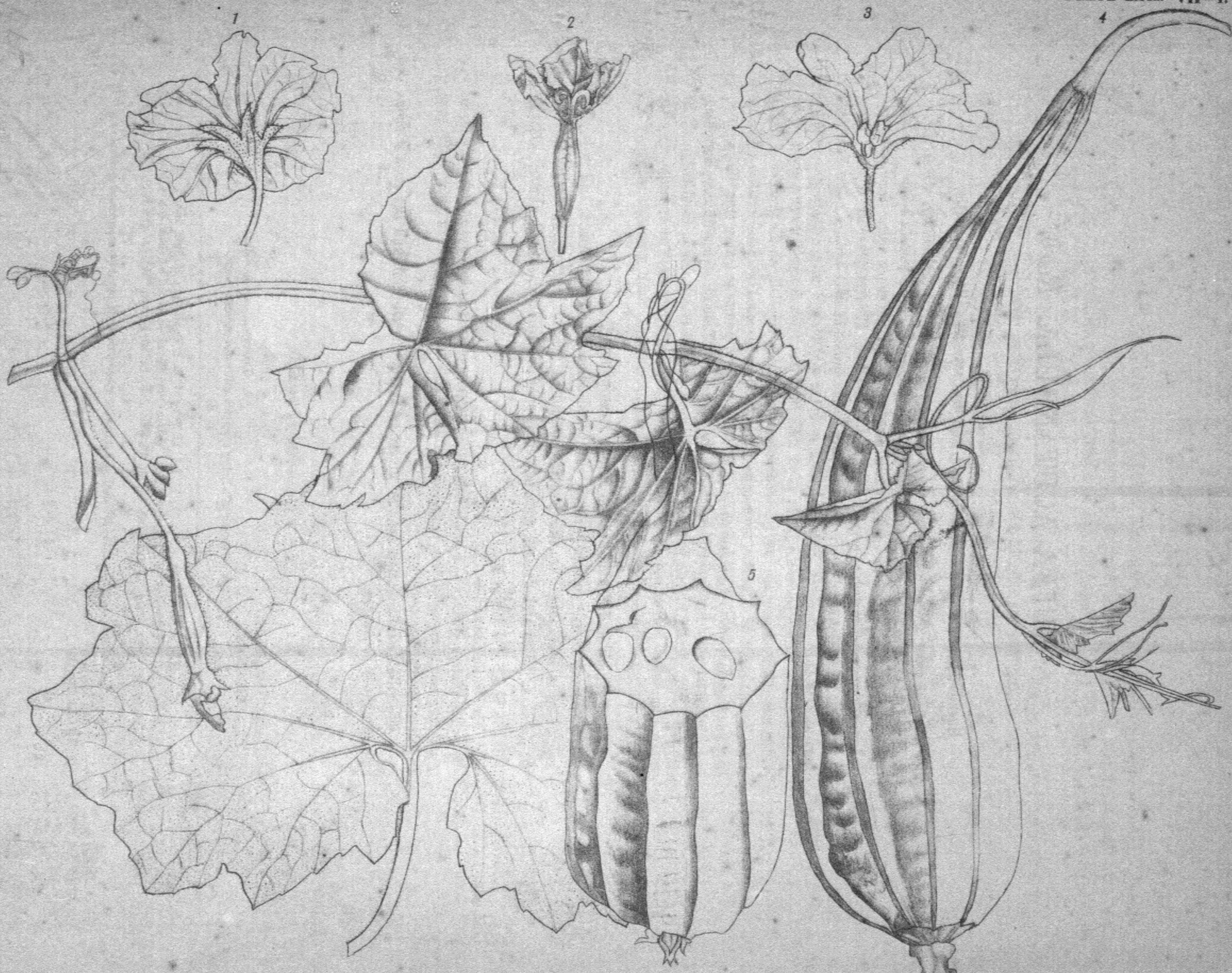
* **References**.—Roxb Hort Beng. 70; Fl. Ind. iii. 713; W. & A. Prod. 343; Fl. Brit. Ind. ii. 615; (Atkinson Econom. Prod. N.-W. P., Part v. p. 6; Gaz. N.-W. P., Vol. x. 700; Naud. in Ann. Sc. Nat. Ser. 4 Vol. 12 p. 122; Cogniaux in DC. Mon. Phan. iii. 459; DC. L'Orig. Pl. Cult. 215; Indian Forester Vol. ix. (1883) p. 201. *Cucumis Acutangulus*, Linn.

† Roxburgh observes:—"There is the rudiment of a lid at the apex of the fruit, but it never separates spontaneously."

‡ DC. L'Orig. Pl. Cult. 216.

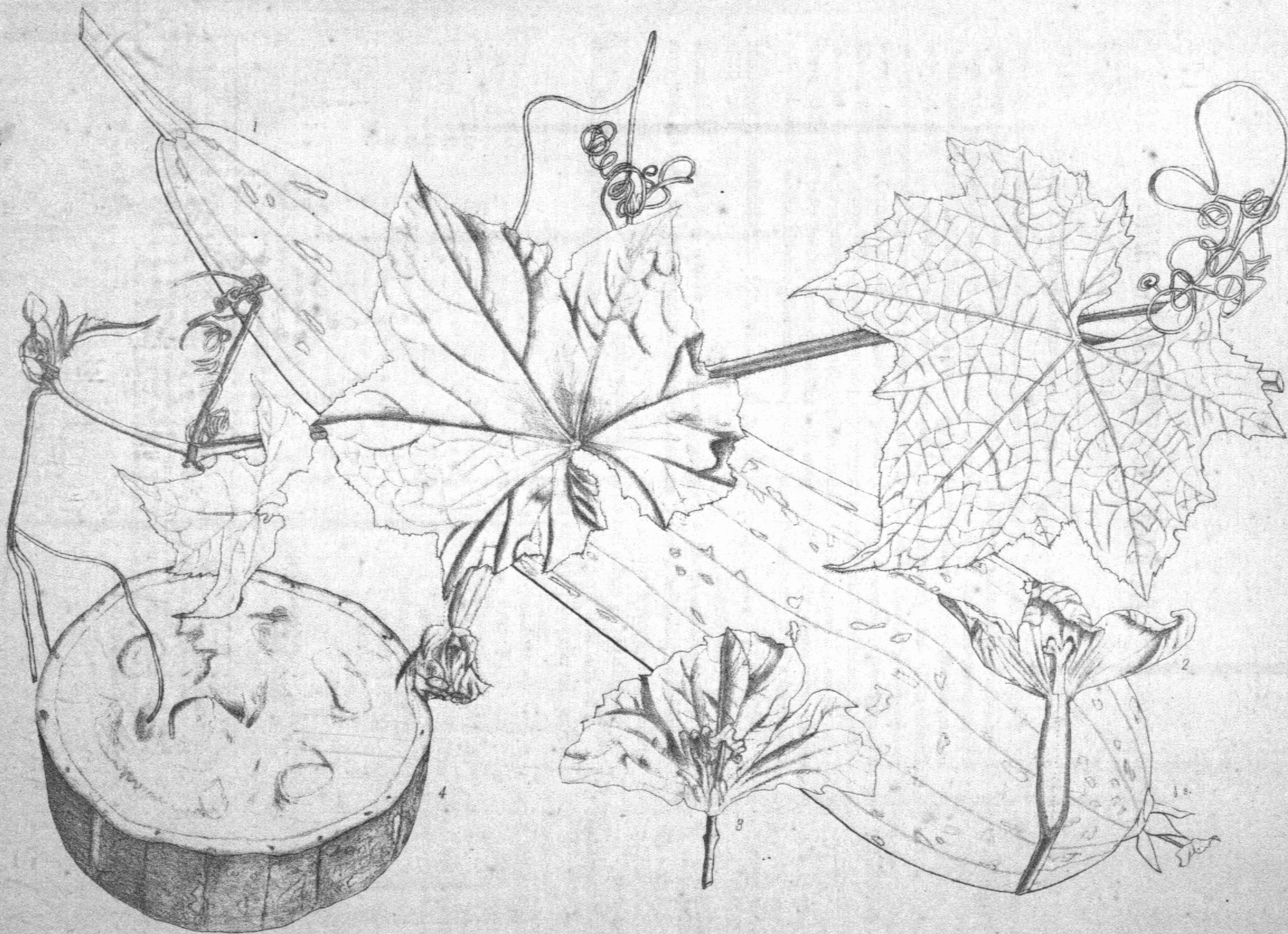
§ Ind. For. l.c.



LUFFA ACUTANGULA, ROXB.

Drawn by H. Hormuzji.

Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.



Drawn by H. Hormusji.

LUFFA ÆGYPTIACA, MILL.

Litho. T. C. Press, Roorkee.
Thos. D. Rona Supdt.

LUFFA ÆGYPTIACA, *Mill.**

[*Vide* Plate LXIII].

ENGLISH, none; VERNACULAR, **taroi, ghiya taroi, turai, dhandhal** (Kumaun).

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Annual, whole plant more or less scabrous. Stems extensively climbing or trailing, 5-angled; tendrils 2-3-fid. Leaves orbicular reniform, 6-7 in. across, palmately lobed or 5-angled; lobes triangular or lanceolate, acute or acuminate, sinuate dentate, bright green, hispid on both sides; petioles 2-3 in., striated, channelled. Flowers rather large, yellow, monœcious; male and female from the same axil. Male flowers in panicles, peduncles long, bracteate at the base, pedicels bracteolate; calyx tube broadly campanulate, segments 5, lanceolate; petals 5, oblong with cuneate base; stamens 5. Female flowers solitary,† peduncle 2-3 in. or more; calyx tube produced beyond the ovary, lobes and corolla as in the male flower; ovary cylindrical, smooth. Fruit 1-3 ft., cylindrical or fusiform, occasionally subtrigonous, with 10 dark green lines which are sometimes elevated into ribs. Seeds black, about ¼ in. long and ⅜-in. broad, oval, compressed, smooth, margins narrowly winged.

Origin.

This plant is a true native of India;‡ it is cultivated or naturalized in most hot countries of the world.

Uses, &c.

This vegetable is used in a similar manner to that of the *kali taroi*. It is much grown in the plains as a rainy season vegetable, and may often be seen trailing over bushes or the roofs of native huts.

Cultivation.

Its cultivation resembles that of the preceding.

Distribution and Area.

The area it occupied in certain of the N.-W. Provinces temporarily settled districts during the rains of 1881 was returned as follows:—

District.	Acres.
Allahabad, ...	256
Meerut, ...	199
Budaon, ...	104
Cawnpore, ...	65
Bijnor, ...	51
Pilibhit, ...	45
Bulandshahr, ...	43
Muttra, ...	37
Jalaun, ...	29

Explanation of Plate LXIII.

1. Ripe fruit (reduced to ½).
2. Female flower.
3. Male flower.
4. Transverse section of fruit.

From a drawing of a living specimen cultivated at Saháranpur.

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* **References**:—Hook. Fl. Brit. Ind. ii. 614; Atkinson Econom. Prod. N.-W. P. Part v. p. 6, Gaz. N.-W. P. Vol. x. 700. *L. pentandra*, Roxb. Hort. Beng. 70; Fl. Ind. iii. 712; W. & A. Prod. 343; Wight Ic. 499; Ill. 105. bis. *L. racemosa* Roxb. l.c. 715. *L. clavata*, Roxb. l.c. 714. *L. cylindrica*, Roem.; Kurz in Journ. As. Soc. Beng. (1877) p. 100; Cogniaux in DC. Mon. Phan. iii. 456; DC. L'Orig. Pl. Cult. 214; Ind. Forester Vol. ix. (1883) p. 201.

† Roxburgh (l.c.) says that the lowermost flower of the male panicle is often female.

‡ DC. L'Orig. Pl. Cult. 215.

MOMORDICA CHARANTIA, *Linn.**

[*Vide* Plate LXIV].

ENGLISH, none; VERNACULAR, **karela, kareli, karola**; Sanscrit, **susuvi.**†

Description.

Natural order *Cucurbitaceæ*, tribe *Cucumerineæ*. Stems extensively climbing or trailing, much branched, 4-angled, hairy, especially towards the extremities; tendrils simple, slender, hairy. Leaves on long petioles, sub-orbicular reniform, hairy below on the veins, bright green above, paler beneath, thin and flaccid; petioles somewhat laterally compressed, deeply furrowed on upper surface; limb 1-3½ in. in diameter, pedately cut nearly to the base into 5-7 lobes; lobes sub-pinnatifid narrowed towards the base, each lobule ending in a mucro. Flowers monœcious, yellow. Male flower :—peduncle long and slender, bracteate near the middle; bracts reniform or orbicular cordate, entire, mucronate, calyx tube tuberculate at the base; segments 5, ovate, acute; corolla 5—partite nearly to the base, segments obtuse or emarginate; stamens 3, filaments short, anthers conduplicate. Female flowers :—peduncle long and slender, bracteate near the base; calyx and corolla as in the male; staminodes 3; ovary fusiform, muricate; style short terminating in 3-bifid stigmas. Fruit oval or fusiform, rostrate, 3-5 in., orange-coloured when ripe, 1-celled with three parietal placentas, 3-valved at the apex; epicarp deeply tubercled, tubercles blunt or sharp. Seeds immersed in a bright red pulpy aril, ½ in. long and a little over ¼ in. broad and about $\frac{3}{10}$ in. thick, brown, sculptured, and with two broad lighter coloured corrugated bands within the margin.

This plant is cultivated all over India in the plains.

Varieties.

There are several varieties differing in the size and shape of the fruit. The rainy season kind, called *kareli*, has rather smaller fruits, and is more esteemed than that of the hot weather variety, known in some districts under the name of *karela*.

Uses.

The fruit is eaten either raw or cooked in curries; it has rather a bitter taste; when sliced and dried it remains good for many months.

Cultivation.

Regarding its cultivation the hot weather variety Mr. Gollan says ‡—

"Should be sown in the end of February and all through March in rich soil. The ground should be "laid out in beds, and the seeds sown in lines 2 feet apart, and the same distance allowed between each seed. "Water should be given twice a week until the ground is covered, afterwards once a week will be sufficient. "The first sowing will come into use about the middle of April, and successive sowings made in March will "keep up the supply until the beginning of the rains."

The rainy season variety must be sown in June, and supports for it to climb upon are necessary.

Area.

It is difficult to ascertain accurately the area occupied by this plant in different

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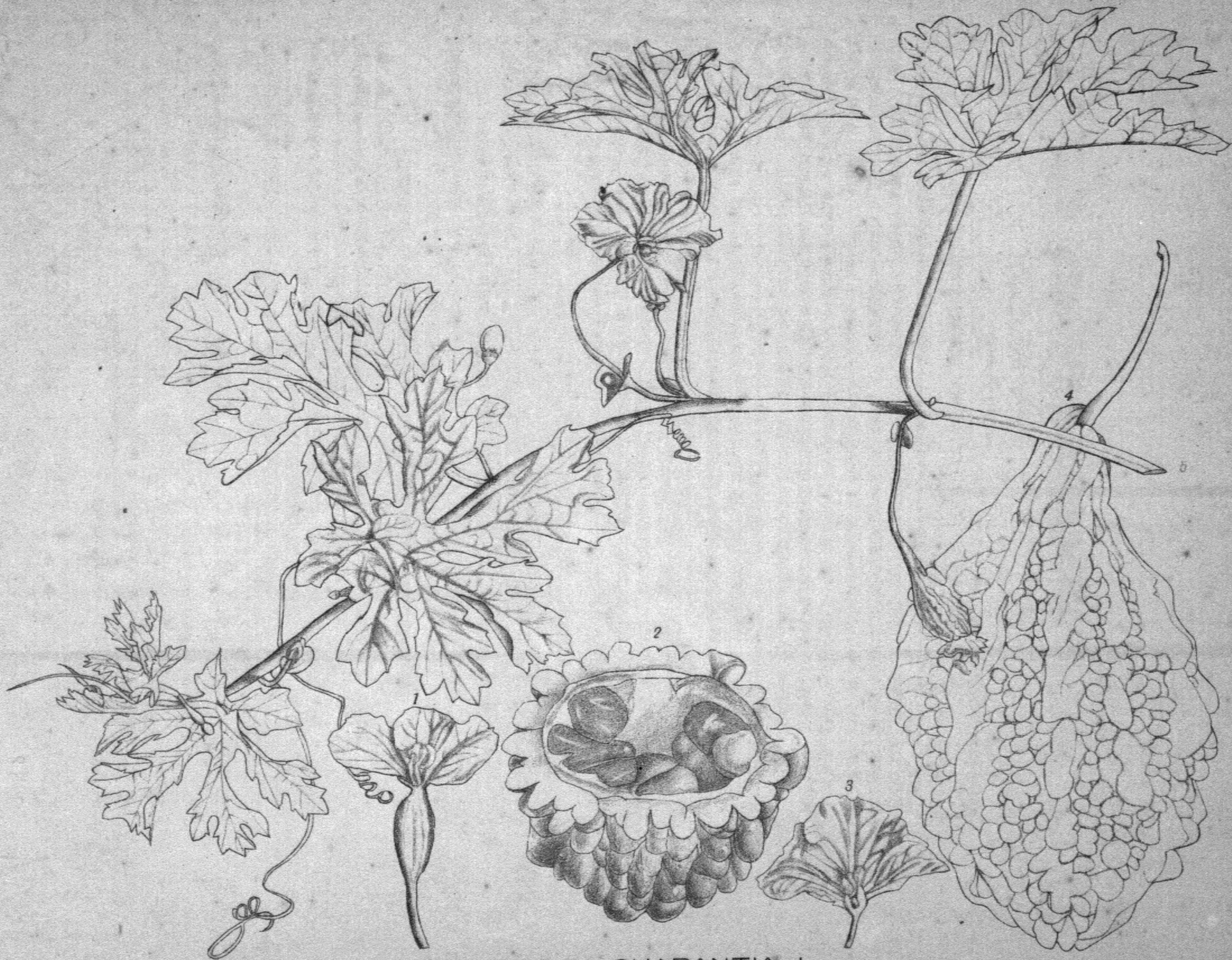
* **References** :—DC. Prod. iii. 311; Roxb. Fl. Ind. iii. 707; W. & A. Prod. 348; Wight Ic. 504; Dalz. and Gibs. Bombay Fl. 102; Drury Useful Pl. of Ind. 306; Hook. Fl. Brit. Ind. ii. 616; Naudin in Ann. Ser. 4, Vol. 12, p. 131; Cogniaux in DC. Mon. Phan. iii. 436; Atkinson Econom. Prod. N.-W. P. Part v. p. 7; Gaz. N.-W. P. x. p. 700; Indian Forester Vol. ix. (1883) pp. 162 and 202. *M. muricata*, DC. Prod. l.c. *M. senegalensis*, Lam.

† Piddington Index 57. (*M. muricata*).

‡ Ind. For. l.c.



MOMORDICA CHARANTIA, L.

Drawn by H. Hormasji.

Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

parts of these Provinces. The following figures were returned as representing the ground occupied in four of the N.-W. Provinces temporarily settled districts during the rainy season of 1881 :—

	Acres.
Muttra, ...	50
Mainpuri, ...	39
Allahabad, ...	19
Bijnor, ...	11

Explanation of Plate LXIV.

1. Female flower, vertical section,
2. Ripe fruit,
3. Male flower,

} nat. size.

4. Fruit,
5. Portion of a branch with a male and female flower,

} nat. size.

From a drawing of a living specimen cultivated at Saháranpur.